CUSACK'S ELEMENTS OF PSYCHOLOGY

BY

S. BLOWS M.A.

2/- NET

CITY OF LONDON BOOK DEPOT
White Street and Finsbury Street,
MOORFIELDS, LONDON, E.C.

THE ELEMENTS OF PSYCHOLOGY.

Digitized by the Internet Archive
in 2024

https://archive.org/details/elementsofpsycho0000unse_m7h1

THE ELEMENTS

OF

PSYCHOLOGY.

BY

S. BLOWS, M.A., B.Sc.,

Senior Lecturer on School Method at the Day Training College, Moorfields, E.C.

Price 2/- net.

London:
CITY OF LONDON BOOK DEPOT,
White Street, and Finsbury Street, Moorfields, E.C.

London:
Straker Brothers & Co.,
"The Bishopsgate Press,"
44-47, Bishopsgate Without, E.C.

PREFACE.

THIS book is primarily intended for Elementary School Teachers preparing for the Government Certificate Examination, and is based on the Lectures given during some years past to large classes of such students at the Cusack Institute.

Bearing in mind the necessarily limited amount of time for reading at their disposal, the subject is treated concisely, but at the same time, it is hoped, fully enough to serve as an introduction to the further study of the subject.

In the preparation of the book reference has been freely made to the standard works on Psychology by Professor James, Professor Höffding, Professor Sully, Professor Ladd, Dr. Ward, and Dr. Carpenter.

S. B.

CUSACK INSTITUTE, E.C.
April, 1897.

CONTENTS.

CHAP. PAGE

I. INTRODUCTORY—Psychology defined 1

II. METHODS OF STUDYING PSYCHOLOGY 6

III. THE NERVOUS SYSTEM 11

IV. THE THREE PHASES OF MIND 18

V. THE INTELLECT—Sensation 22

VI. SENSUOUS PERCEPTION 26

VII. THE SENSES—Taste, Smell, Touch, Temperature .. 29

VIII. THE SENSES (*continued*)—The Muscular Sense .. 35

IX. THE SENSES (*continued*)—Hearing 39

X. THE SENSES (*continued*)—Sight 46

XI. MEMORY 55

XII. MEMORY (*continued*)—Association of Ideas 61

XIII. MEMORY (*continued*)—Recollection, Forgetfulness .. 68

XIV. IMAGINATION 75

XV. CONCEPTION 83

XVI. JUDGING 89

XVII. REASONING 95

XVIII. INDUCTIVE REASONING 99

XIX. DEDUCTIVE REASONING 104

CHAP. PAGE

XX. FEELING 107

XXI. THE WILL.. 114

XXII. ATTENTION 118

XXIII. HABIT 127

XXIV. MENTAL DEVELOPMENT.. 135

XXV. MENTAL DEVELOPMENT (*continued*) 141

On earth, there is nothing great but man ;
In man, there is nothing great but mind.

SIR WILLIAM HAMILTON.

Grant that the phenomena of intelligence conform to laws ; grant that the evolution of intelligence in a child also conforms to laws ; and it follows inevitably that education cannot be rightly guided without a knowledge of those laws.

HERBERT SPENCER.

Examination of the mental faculties and of their reference to education is absolutely necessary.

QUINTILIAN.

THE ELEMENTS
OF
PSYCHOLOGY.

CHAPTER I.

INTRODUCTORY.

We all know the saying "Knowledge is Power,"—few of us stop to consider what is implied by the word "knowledge";—knowledge of what? What is there of which we are capable of knowledge? The subject matter of all possible human knowledge is contained in two realms, an *outer* and an *inner*, the world without, or matter, and the world within, or mind. Our knowledge is first concerned with things outside of ourselves. The child is at first not conscious of himself; he *first* is conscious of changes taking place in the external world. He is conscious for instance of some change having taken place when a dark room is suddenly illuminated, or when a loud noise is suddenly made. After a time he begins to find out that these changes have meaning for *him*. He learns to say "I see a light," "I hear a sound." He gradually learns to speak of himself in the *first* person, from hearing other people speak of themselves in the first person. He hardly does this before the end of the third or fourth year of his life. He has by that time reached the stage indicated by Tennyson in the lines:—

> "But as he grows he gathers much,
> And learns the use of 'I' and 'me,'
> And finds 'I am not what I see,
> And other than the things I touch,'"

But he is far from the stage at which such questions can be asked as "What is this I"? or "What do I know about this I"? The serious asking of questions like these denotes a stage of mental development from which children are still far distant, and which the majority of adults never reach. Such questions direct the attention to the *second* of our two realms of knowledge.

Organised knowledge of some subject matter is what is meant by **Science.**

Physical Science treats of the *outer* world, the fundamental ideas of which are *matter* and *space*.

Mental Science treats of the *inner* world, the fundamental ideas of which are *knowing*, *feeling*, and *willing*.

Mind may be defined as that within us which *knows*, *feels* and *wills*. Various synonyms are often used for mind. Such terms as *soul*, *spirit*, *ego*, *self*, *subject*, may all be regarded as synonymous with *mind*.

The word **Subject** deserves special attention as it is of such frequent occurrence in all books on mental science. Since the active mind is often called the subject, anything belonging entirely to, or produced entirely by the mind is spoken of as *subjective*. Anything that exists independently of the *subject*, and can be perceived, imagined, or thought of by such subject is an *object*, and everything belonging to such "objects" is described as *objective*. For example, while writing this I see the pen with which I am writing. That the pen exists independently of myself, and exists when not seen by me or by any one else, would, by most people be regarded as an unquestionable fact. This existence of the pen, apart from, and independent of any mind, is entirely *objective*. But not only do I see the *pen*, but *I see* the pen. The pen as an object occasions an activity of my mind by which the pen is seen by *me*. This activity of the ego, consequent upon the presence of the object, is the *subjective* factor in the act of my seeing the pen. In some cases the subjective factor is present when there is no *object* to occasion it. Thus, in dreams, what is seen is purely subjective.

Just as physical science is divided into many branches such as, Physics, Chemistry, Mechanics, etc., so mental science is divided into many branches, one of which is **Psychology** the subject matter of this book. There are, however, many other branches such as ethics—the science of conduct; politics—the science of government; sociology—the science of societies; logic—the science of reasoning; pedagogy—the science of education; æsthetics—the science of the beautiful in nature and art.

Psychology is that branch of mental science which treats of the phenomena of knowing, feeling, and willing. Any particular mental activity may be called a "state of consciousness" or a "**psychosis**," and the special object of psychology is the discovery of relations between different states of consciousness. It does not concern itself with what the mind is in itself, it studies only the phenomena of mind and the relation between them. If psychology attempts to explain the real nature of mind, it ceases to be psychology, and becomes **philosophy** or **metaphysics**, which is the science which has for its aim the discovery of the real nature of matter, and of spirit, and of the relation between them.

Psychology has a more or less close connection with all the other branches of mental science, but with one particularly, the science of education, its connection is most intimate. Education aims at the perfection of the various powers of the mind. It is evident the more the educationist knows about the mind the better will he be able to lay down laws for its proper guidance. As Herbert Spencer says, "Granted that the phenomena of intelligence conform to laws; granted that the evolution of intelligence in a child also conforms to laws; and it follows inevitably that education cannot be rightly guided without a knowledge of those laws." The teacher is the artist who puts to practical use the precepts supplied by the science of education. His object, therefore, should be to insure the attainment by his pupils of the highest possible pitch of mental excellence. Hence it is clear that a competent knowledge of psychology is indispensable to the teacher.

When we are ill there are always friends ready to suggest remedies which they are "sure" will work the desired cure, as they have already cured other cases "exactly like" ours. And yet, as a rule, we do not try these "remedies," but follow the advice of a regular medical practitioner. Why? We know that the confidence of our friends is based upon a narrow experience, and we know that such empirical knowledge often proves untrustworthy; on the other hand, we put greater confidence in the medical man's advice, because we think that he has a scientific knowledge of the anatomy and physiology of the body. What *anatomy* and *physiology* are to the medical practitioner, *psychology* is to the teacher, and can no more be dispensed with by the latter than can anatomy and physiology by the former. It is not, however, to be supposed that a knowledge of psychology alone will make one a good teacher. Teaching is essentially an art, and can no more be learned without practice in it than one can learn to play the violin by theory alone. Still a competent knowledge of psychology renders advance towards proficiency in teaching much easier and more rapid.

Résumé.

I. **Knowledge.**—
  1. Of outside things first.
  2. Knowledge of self much later.

II. **Physical Science,** has *matter* and *space* as its fundamental ideas.

III. **Mental Science.**—
  1. Fundamental ideas.
    a. Knowing }
    b. Feeling } Consciousness.
    c. Willing }
  2. Different branches.
    a. Psychology.
    b. Ethics.
    c. Politics.
    d. Sociology.
    e. Logic.
    f. Æsthetics.
    g. Pædagogics, or Pedagogy.

IV. **Mind.**—
  1. Definition.—That within us which *knows*, *feels*, and *wills*.
  2. Synonyms.—Soul, spirit, ego, self, subject.
  3. Subjective and objective.—
    a. Anything belonging to or existing only in the mind is called *subjective.*
    b. Everything else is *objective.*

V. **Psychology.**—

1. It treats of:
   - *a.* Phenomena of mind.
   - *b.* Relations between them.
2. It is connected with
   - *a.* Metaphysics.—Metaphysics seeks a knowledge of what mind and matter are in themselves, and an explanation of the relation between them. Psychology studies only the *phenomena* of mind.
   - *b.* Education.—Psychology bears the same relation to education that physiology and anatomy do to medicine.

CHAPTER II.

METHODS OF STUDYING PSYCHOLOGY.

It might seem the easiest thing possible to study one's own mind. It is always with one, and is apparently, therefore, most convenient for study at all times. But in reality the study of one's own mind is one of the most difficult of studies. In doing this the Ego is both subject and object, for the mind is studying itself. This method of studying psychology is known as the **subjective method,** or the method of **introspection** ; and it needs but little thought to see that such a method is subject to great and peculiar difficulties.

In the *first* place the phenomena of mind are not presented to the senses as are the phenomena of the objective world. We cannot *look* at a thought as we can at a plant, or *listen* to a *feeling* as we may do to a sound.

A *second* inherent difficulty is that directly we turn our attention to an existing state of consciousness such state immediately changes and tends to vanish, for the mind now being absorbed in a new activity (the consideration of a conscious state), unless it can carry on two or more simultaneous activities, must cease from its previous state of activity. This difficulty is so great that some writers have declared it *impossible* to study our own minds by introspection. This is, however, an over-statement of the difficulty, for even though the state of consciousness under examination for the time being ceases to be, still we can recall it by an effort of memory. Thus people often say "I wonder what reminded me of that."

Such words indicate a greater or less effort to recall the process by which an idea is recollected. If such state can be recalled, then memory gives us a means of studying it. Mill says, "a fact may be studied through the medium of memory, not at the very moment of our perceiving it, but the moment after; and this is really the mode in which our best knowledge of our intellectual acts is generally acquired."

II. A *third* difficulty arises from the fact that our states of mind are so familiar to us that they do not usually arrest our attention. We fail to notice them, partly because they are matters of every day occurrence. Hence the study of these states demands a great power of abstracting the attention from what is striking, and fixing it on objects so familiar as to be in no way striking.

Difficult as the method of introspection is, it must be employed by every one who wishes to gain any real knowledge of psychology. To study psychology from a text book without verifying its statements in one's self is like studying botany from a book, and not testing its statements by reference to actual plants.

The introspective method is not, however, the only possible way of obtaining psychological knowledge—there is also an **objective method** of studying the subject. Under this are included several distinct branches of the subject all capable of yielding useful help.

The *first* of these is the study of the minds of others. This method of study also confronts the inquirer with peculiar difficulties. The mind of another is not an object that can be seen and handled like a plant. What we perceive in another are only bodily actions which have first of all to be interpreted in terms of mental activities, and the only possible way of doing this is by the help of our own experience. I know for instance, in my own case, that certain gestures, or certain bodily attitudes, are the result of certain mental activities—when, then, I see similar gestures or attitudes in another, I at once *infer* that they have corresponding antecedent mental activities, the existence of which is, therefore, for the observer possible only in the light of his own experience. The difficulty here is, the liability to misinterpretation. This difficulty is especially great in studying the minds of adults, for every adult has become more or less conventional. It would often be impolite, and still more often impolitic, to show by our looks every thought that comes into our minds.

The study of the child mind has become almost a separate branch of psychology. By it much important information may be obtained. The child mind is ever flitting from one mental state to another, and every change is immediately manifested, or at least there is no attempt made to hide it. Hence the danger of misinterpretation is much less in the case of children, than in the case of adults. Children are, as all know, more "transparent" than adults. He who studies the mind of children is, however, extremely liable to over-interpret their expressions; in other words to read into their minds what is only in his own. As a French writer has said, "in studying these dear little ones we are often the dupes of ourselves."

Many useful results have also been obtained by the study of the minds of savages and uncivilised races. Much useful help has been given to psychology too by the study of pathological cases, that is, cases of minds in a diseased or abnormal state. Much may be learned about a faculty by noting how one acts who has lost such faculty. The study of the manifestations of feeling, will, and intelligence in animals has also been productive of an increase in the general stock of mind knowledge.

There still remains one branch of objective psychology which within the last 30 years has shown itself to be of immense use in psychological studies. This is called **experimental psychology.** The name explains itself. It is an endeavour to turn psychology into an experimental science. It is evident that many mental activities are indirectly capable of being experimented upon. Thus the least amount of physical stimulus capable of producing a sensation, the length of time taken in recognising an object suddenly brought into view, the distance that must exist between two pin points pressed on any part of the skin, to be felt as two, and many other similar quantities are capable of more or less exact measurement. Observers in this field have collected a vast array of facts and have thus greatly advanced psychological knowledge.

One other indirect means of studying psychology should be mentioned. It is a recognised fact that every mental activity is conditioned by a nervous activity. Hence valuable information may be obtained by the study of the brain and nerves. This method of studying psychology indirectly through the physiological conditions of mental activity is called **Physiological Psychology.** In studying the conditions under which mental activity is possible we are clearly gaining important knowledge about the activity itself. Even the study of physical conditions called **Psychophysics** has sometimes been of great service to psychology. An excellent example of this is to be found in the researches of Helmholtz on "Sound."

Before his experiments on the subject every one thought that the perception of an ordinary musical tone was a simple unanalysable mental fact. His experiments proved that the tone was the result, not of the mere repetition of a single vibration, but of a complex system of vibrations, and hence that the tone as heard was not simple but correspondingly complex. When this was pointed out it was found quite possible to perceive by the unaided ear several elements in the tone which was previously regarded as simple.

Psychology is so difficult a subject that it is only by a combination of the results of all these different methods, that one can hope to see any real advance made. Psychology is a science, and as such its aim is not the mere collecting of a large number of isolated facts about individual minds, but, by the comparison of such facts, it aims at bringing out what is common to minds in general; in other words, it seeks to make general statements about minds in general. In so far as it fails to do this, it fails to be a *science*.

Résumé.

I. **Introspective method.**—By this method a particular mind studies its own phenomena. The method presents special difficulties.

1. Mind phenomena are not capable of being perceived by the senses as are objective *phenomena*.
2. The consideration of any mental phenomenon by introspection necessarily implies the fading or com-

plete disappearance of such phenomenon. This difficulty can be partly overcome by the exercise of memory.

3. Great power of abstraction is needed to study things so familiar as are our ordinary mental phenomena.
4. The introspective method is absolutely necessary to the gaining of any real mind knowledge.

II. **Objective method.**—

1. The study of mind in others.—
   - *a.* In *Adults.* The great difficulty here is to avoid misinterpreting bodily expressions of mental activities.
   - *b.* *Children.* In this the psychologist is apt to read into the child mind phenomena that exist only in his own.
   - *c.* *Uncivilised races.*
   - *d.* *Pathological cases:* as in fever, madness, &c.
   - *e.* *Animals.*
2. *Experimental psychology.*
   - *a.* Many mental phenomena are capable of approximately exact measurement—hence the application of experimental methods.
   - *b.* It has proved productive of great results.
3. *Physiological Psychology.*—This concerns itself mainly with the physiological conditions of mental activities.
4. *Psycho-physics.*—This is the study of the physical conditions of mental phenomena.

III. **Individual minds** are not, but mind in general is, the real subject matter of psychology.

CHAPTER III.

The Nervous System.

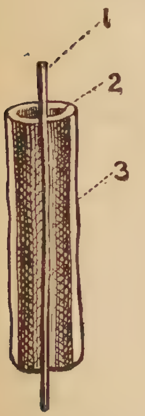
Every mental activity is accompanied by a nervous activity. Hence it is important that the student should have some idea of the nervous system. The nervous system may be regarded as consisting of three parts.

1. Nerves. 2. Spinal Cord. 3. Brain.

I. **Nerves.**—These all end in or lead from the brain. Near the brain or spinal cord these nerves consist of a somewhat large white-looking cord. These cords are, however, not simple nerves, but each consists of many elementary nerve fibres bound together by a connecting substance. It is only near their termination that these nerves become single nerve fibres.

An elementary nerve fibre consists of a central fibre, called the *axis cylinder;* this is covered by a white material called the *white substance of Schwann*; and this is surrounded by a thin covering or sheath known as *Schwann's sheath*, or the *primitive sheath*.

A compound nerve consists of several elementary nerve fibres, which do not coalesce but lie side by side, the cylinders being kept from actual contact by the



Elementary Nerve Fibre.

1. Axis Cylinder. 2. White substance of Schwann.
3. Primitive sheath.

white substance and *sheath of Schwann.* A compound nerve is like a multiple telephone wire, which consists of many connected wires mutually insulated by some non-conducting substance.

The function of nerves is to act as conductors or carriers. Thus, if one places his finger on a hot surface the heat affects a nerve, which has in consequence some disturbance set up in it, and which straightway transmits this disturbance (or an impulse resulting from it) to the brain. A *sensation* of pain results, and an impulse is sent back from the brain along *another* nerve fibre to the muscles of the burnt finger, in consequence of which the finger is withdrawn from the hot surface.

Classification of nerves.—According to function, all nerves may be arranged into two classes. **1.—Afferent nerves. 2.—Efferent nerves.**

Afferent, or in-carrying nerves, are those which transmit nervous activity from the body surface to a nerve centre (generally the brain). These are sometimes called *sensory* nerves, as their excitement generally results in sensation.

Efferent, or outcarrying nerves, are those which transmit impulses from a nerve centre (generally the *brain*) to the various muscles. These are sometimes called *motor* nerves, as from their activity muscular movements generally result.

The Spinal Cord.—This is the mass of nervous matter which fills the canal running through the greater part of the length of the backbone. The external part of the cord consists of a whitish substance, while the inner part is of a greyish or dirty white colour. The white substance consists of nerve fibres leading to the brain. Thirty one pairs of nerves from different parts of the body enter the spinal cord. The nerve fibres no more coalesce in the spinal cord than they do in the compound nerves, but are continued individually to the brain. The grey substance of the spinal cord consist in parts of these fibres, but contains besides numerous cells called *nerve cells*, which may occur singly, but more frequently occur in groups, each of which is called a *ganglion*, and the individual cells *ganglionic nerve cells*.

Function of spinal cord.—Its most important function is to conduct nerve disturbances up to and down from the brain. The ganglionic centres enable it, however, to perform an altogether different function. Some nerve disturbances are not transmitted beyond these ganglionic centres. On reaching such centre an *afferent* impulse may give place to an *efferent* one causing muscular movement. Such a nervous activity and resulting muscular movement is called *reflex*, the nervous commotion being regarded as reflected from the ganglionic centre. Reflex actions are not accompanied by consciousness, for no nervous activity results in consciousness unless it is transmitted to the brain.

The Brain or Encephalon.—The brain may be regarded as an enlarged and specialised prolongation of the spinal cord, and consists of all the nervous matter contained in the cavity of the skull. It may be regarded as consisting of four parts. Beginning from below and proceeding upwards, these are in order:—

1. **The Medulla Oblongata.**
2. **The Cerebellum.**
3. **The Pons Varolii.**
4. **The Cerebrum.**

I. **The Medulla Oblongata.**—This looks like a mere enlarged prolongation of the spinal cord. It is about 1¼ inches in length, and enlarges as it proceeds upwards. Its internal structure is more complex than that of the spinal cord. It contains a large number of important ganglia, which by a reflex activity regulates and governs such important vital activities as the beating of the heart, movement of respiration, and muscular actions in swallowing. These being reflex activities, go on without consciousness, and therefore without the exercise of the will. Thus movements involved in breathing and in blood circulation go on even while we sleep.

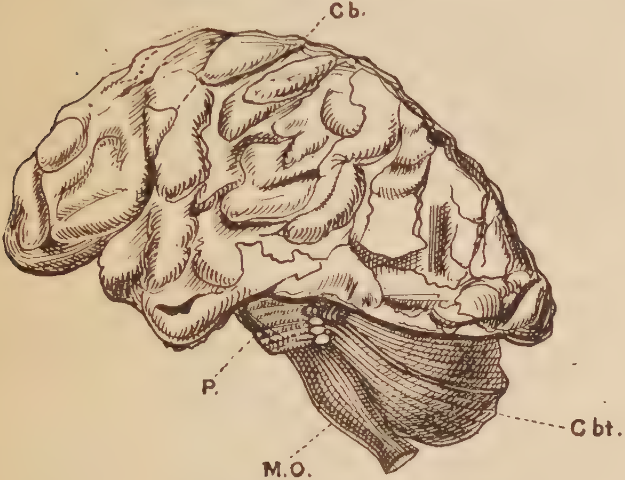
II. **The Cerebellum** is an apparent outgrowth from the base of the brain which almost entirely covers the *medulla oblongata*. In this part of the brain the grey matter is external and the white internal, the converse of the arrangement in the cord and medulla. The function of the cerebellum is unknown; some have, however, thought that it is in some way connected with the muscular sense.

III. **The Pons Varolii** is an enlargement of the prolongation of the *medulla oblongata* lying beneath the *cerebellum*. It consists largely of transverse fibres which connect one side of the cerebellum with the other. It contains a number of ganglionic centres.

IV. **The Cerebrum** is the most important part of the brain. It forms all the upper part of the brain, and is far larger than all the other parts put together. It is divided by a deep longitudinal fissure into two halves, or *hemispheres* as they are called. At the base of the cerebrum are several large and important ganglia connected with the special organs of sense. The surface of the hemispheres is, in adult life, arranged in *folds* or *convolutions*, separated from one another by furrows or fissures. The external layer of the cerebral hemispheres is called the *cortex*. This cortex consists of grey matter, and contains enormous numbers of nerve cells. The area of the cortex is largely increased (approximately doubled) by means of the convolution, and as the cells of the cortex are the active originative part of the cerebrum, the importance of these convolutions is seen to be very great. In close contact with the cortex is a membranous layer, which is a mere network of veins and arteries, which supply the brain with blood. This membrane, which is known as the *pia mater*, remains in close contact with the cortex, even in the fissures between the convolutions, thus providing for a supply of blood to every part of the cortex.

The Brain the seat of the mind.—The brain is the part of the body most intimately connected with the mind ; there is no mental activity without an accompanying brain activity. To excite consciousness, the disturbance set up in a nerve must be transmitted to the cortex of the hemispheres. If the impulse does not reach the cortex, but is reflected from some lower centre, whatever action may result is of the kind called *reflex*, and is therefore independent of the *will*, for *will*-ing evidently involves consciousness.

Brain work and rest.—The activity of living matter (nervous or muscular) always means waste. The untired normal brain always contains a store of energy. This energy is stored in the cells in certain chemical compounds which easily undergo decomposition, thus giving out the energy stored in them. We may compare the energy of a cell to the energy of a loaded cannon. The energy is in this case stored up in the powder, which is ready to give it up at a moment's notice. Moreover, when the cannon is once fired, all the energy of the powder is discharged into the ball, and it cannot be fired again until it has been re-loaded. So in the case of a brain cell. When it has discharged its energy it must have time to become re-charged before it can act again. What is true of a single cell in this respect is true of the whole brain, with the reservation that it seldom happens that all the energy of the whole brain is discharged, for while one group of brain cells is very active other groups are recuperating. This recuperative power of the brain depends upon a plentiful supply of pure blood. The brain receives its blood supply, as we have already seen, through the *pia mater*.



Side View of Brain ($\frac{1}{3}$ natural size).

M.O. Medulla oblongata. P. Pons varolii.
Cbt. Cerebellum. Cb. Cerebrum.

The activity of the brain may be judged of from the fact that while the mass of the brain is only about $\frac{1}{45}$ of that of the body, about $\frac{1}{8}$ of the whole blood supply of the body is required by the brain. Hence it is clear that good food and a plentiful supply of fresh air are necessary for those who have much mental work to do, for these are the requisites for a good blood supply. Moreover, recuperation always requires time, and hence brain work cannot be continued without periods for rest and recreation.

The Sympathetic nervous system.—This consists of a pair of cords lying one on either side of the back bone, and several ganglia in different parts of the body. What is known of this system has, however, little interest for the purpose of the present book, and no further reference will be made to it.

Résumé.

I. The Cerebro-spinal nervous system.

1. *Nerves.* Individual nerves consist of an *axis-cylinder*, the *white substance of Schwann*, and *Schwann's sheath*. Nerves are :
    - *a. Afferent, incarrying or sensory.*
    - *b. Efferent, outcarrying or motor.*
2. *Spinal Cord.* This consists of :—
    - *a.* Fibres which may be regarded mainly as continuations of nerve axes upwards to the brain.
    - *b.* Cells which often occur in groups called ganglia. These ganglia may serve as *reflex* centres.
3. *Brain.* This consists of :—
    - *a. Medulla oblongata.* An enlarged prolongation of the *spinal cord.* It consists of fibres and important ganglionic centres.
    - *b. Cerebellum.* An outgrowth from the main upper end of the medulla oblongata which it overlays.
    - *c. Pons Varolii.* An enlargement of the main axis of the brain at the base of the cerebellum.
    - *d. Cerebrum.* This is divided by a furrow into two hemispheres. It consists of (1) fibres, and (2) *cells.* These cells in the cerebrum are external, forming the cortex. Its area is greatly increased by convolutions.

II. The Brain the seat of mind.

1. Nervous activity to produce consciousness must be transmitted to the cortex of the cerebrum.
2. *Reflex* actions result from the return of nerve commotion from the lower centres.

III. Brain work and rest.

Mental work involves the waste of energy in brain cells. To make good this waste are needed:

1. Good food. } To form pure blood.
2. Fresh air. }
3. Rest.

CHAPTER. IV.

THE THREE PHASES OF MIND.

The mind of any one individual is one and indivisible, but yet the states of consciousness in which such mind is manifested are very different at different times. It is evident that a state of consciousness in which toothache is the predominant feature is very different from one which is mainly intent upon the solution of some mathematical problem. In studying any branch of science one of the most important things to be done is to arrange the objects which form the subject matter of such science into groups or classes of resembling objects. Now the subject matter of psychology is **states of consciousness.** These then must be classified. "The psychologist dissects mental phenomena into elementary states of consciousness, as the anatomist resolves limbs into tissues, and tissues into cells. The one traces the development of complex organs from simple rudiments; the other follows the building up of complex conceptions out of simpler constituents of thought." * What then are these elementary states of consciousness? I *know* something, I *feel* somehow, I *will* something—these three include every possible state of consciousness. All the phenomena of mind then, may be arranged under one or more of these headings:—

1. **Knowing or Cognition.** 2. **Feeling, and**
3. **Willing or Volition.**

---

* Huxley's "Hume."

Knowing or cognition is the being aware, or the becoming aware, of relations which are either:

1. Between the ego and an object, or
2. Between two states of consciousness.

Thus, to *remember*, is an act of cognition, and is essentially to become aware of a *relation* of likeness between a past state of consciousness and a present one, the cause of such past state being no longer present. Every mental activity that has directly to do with acquisition of "knowledge" may be classed under the head of *knowing*, *cognition*, or *intellection*.

Feeling.—Under this heading is put every state of consciousness, in so far as it is pleasurable or painful. Thus, *anger*, *hatred*, *love*, *sympathy*, *remorse*, are feelings.

Willing.—Is that form of mental activity which leads to actions. It covers not only those cases in which we consciously "make up our minds" to act, but many others where the action follows apparently automatically. Thus the soldier on hearing the word "Attention" uttered in a special way instantly assumes a certain attitude without consciously having "made up his mind" to do so. Such cases involve at least former exercises of the will. The apparent automatic response to the stimulus is due to *habit*, of which more will be said hereafter. As an illustration of the above three phases of mental activity consider the case of a child plucking a flower. The child sees it, perhaps smells it, and at least recognises it as a flower, and these are all acts of cognition, for they all involve being aware of some connection between a present and past state of consciousness.

The child has perhaps a *feeling* of joy at finding it, or a *feeling* of the pleasure that will be derived from the possession of it; the child *likes* to pluck the flower, else it would not do so, and *liking is a feeling*.

The *desire* to possess the flower naturally leads him to attempt to get it. This attempt to obtain it is the result of a *volition* or act of *will*. He *sees* it, *desires* it, *wills* to get it, and acts accordingly.

The student must carefully note that the above classification of mental phenomena is the result of an abstraction. Just as we may talk of a *yellow* colour, although we know such cannot exist of itself but only in and through some object in company with many other attributes of such object, so we must remember when we talk of a cognition *that such cannot exist unaccompanied by feelings and volitions.*

In every mental act all three phases are involved, though sometimes one, sometimes another of the elements preponderates. Hence the concrete state of mind answering to the abstract *cognition* is one in which the *knowing* element preponderates but does not absorb the whole of the mental activity.

Thus, in the study of arithmetic, say, *knowing* is predominant; in the case of toothache, *feeling*; and in resolutely setting ourselves to accomplish some object, *volition* is the predominant factor.

Closely connected as these three phases of mind are, there is a certain opposition between them. The human mind is of finite capacity, and it is highly important to remember that therefore the mind which is absorbed by any one of the three phases of consciousness cannot at the same time manifest itself in the others. Thus the mind overcome with grief or elated with joy cannot, so long as such state of *feeling* lasts, do good *intellectual* work. Teachers have examples of this constantly brought under their notice. They know that their classes on the last half day before the summer holidays are too greatly excited to do much real work—*feeling* is the predominant feature. Hence one condition of good intellectual work is the removal of everything that tends to greatly excite the feelings. How *volition* and *intellection* result from *feeling* will be brought out later when treating of feeling.

Résumé.

I. Phases of mind.

1. **Cognition.** This is the name given to every mental activity concerned with the acquisition of knowledge. **Intellection** and **Knowing** are synonymous with *cognition.*

2. **Feeling.** That form of mental activity concerned with our pleasures or pains.
3. **Volition** or **Willing.** That form of mental activity that is the immediate cause of action.

II. The mind a unit.

1. These three, *Cognition, Feeling and Volition*, are not different parts of mind, but are merely different forms of activity of the same mind.
2. There is an opposition between these phases, for the more any one form of activity prevails the less the possibility for the time being of the others. Keen feeling is especially inimical to *intellection* and *volition* leading to regulated action.

CHAPTER V.

THE INTELLECT—SENSATION.

The intellect may for didactic purposes be regarded as consisting of the faculties of:—

1. Sensation.
2. Perception.
3. Memory.
4. Imagination.
5. Conception.
6. Judgment.
7. Reasoning.

The student must, however, be cautioned that, just as by an act of abstraction we may attend to any one of the three phases of mind, so it is only by an act of abstraction that we can attend to any of the above faculties apart from the rest and that therefore the intellect is not to be regarded as a "bundle of faculties," but as one and indivisible, the above faculties representing successive stages in its development rather than possible divisions of it when fully developed. (See Ch. XXV. on Development.)

Sensation is the simplest act of intellection. It may be defined (as far as it admits of definition) as *a simple mental activity* consequent upon the propagation of a nervous disturbance from the end of an afferent nerve to the cerebral hemispheres. There are three elements involved in every act of sensation.

1. A *physical* stimulus of the end of an afferent nerve.
2. A *physiological* change in the nerve to transmit such stimulus to the brain.
3. A *mental act* which is the sensation.

The first and second of these elements are necessary to an act of sensation, although they form no part of such act. In sensation the mind takes no cognisance of anything outside of itself. Certain parts of the body are specially adapted for receiving stimuli to be transmitted to the brain. They are called *sense-organs*, and the power to receive impressions through any one of them is called a **sense.**

There are the traditional five senses:—

1. Sight. 2. Hearing. 3. Touch. 4. Taste.
5. Smell.

There are, however, several other senses, two of which are important. They are:—

6. The Muscular sense. 7. The Temperature sense.

There are certain respects in which sensations may be discriminated. In the first place the sensations resulting from the activity of one sense organ are, as a rule, easily distinguished from those resulting from the activity of any other. Thus we easily distinguish a sensation of sight from a sensation of sound. Sensations from the same sense organ may be discriminated in respect of:—

1. Intensity. 2. Duration. 3. Quality.

Intensity.—That sensations differ in intensity is evident. A sound may be loud or faint, a light may be brilliant, or so faint as to be scarcely visible. Between the extremes there is every possible gradation.

It should be noticed that when we speak of a light as being more or less bright, we are really describing our own subjective sensations as being more or less intense. Changes in the intensity of sound play a most important part in music.

Sensations are also clearly to be discriminated by differences in **duration.** Light may last but a very small fraction of a second (*e.g.* a lightning flash) or it may continue for any length of time.

Further, sensations differ in **quality.** By the **quality** of a sensation is meant the differences other than those of intensity and duration that may exist between different sensations received through the same sense-organ. In the case of light the quality is the colour. In sound the quality is the pitch and the characteristics by which sounds of the same pitch may be distinguished from each other.

Further, some sensations have characteristic qualities depending on the part of the organ affected. This difference is known as "**Local Character,**" and is of vast importance, as it is owing to this that we are able to distinguish one sensation from another similar in intensity, duration, and otherwise in quality. Thus a pin prick on the left little finger is distinguishable from one on the right little finger, and must therefore be in some way different from it. We shall return to this in connection with the different senses.

Intellectually the most important point about sensation is whether or not sensations that differ but slightly can be discriminated. The sensations resulting from the activity of the different sense organs differ greatly in this respect. A sense is said to be *refined* when its sensations, though differing but slightly, can be easily discriminated. The different senses are not equally capable of refinement. *Taste* and *smell* are comparatively coarse and unrefinable senses, while *touch*, the *muscular sense*, *hearing*, and *sight*, are capable of a high degree of refinement. By exercise the discriminative power or refinement of a sense may be vastly improved. Even the coarse sense of taste attains a high degree of refinement through the constant exercise to which it is subjected by tea-tasters and wine-tasters. Trained musicians are able to discriminate between the pitch of two sounds when the rates of the vibrations producing them differ only by a small fraction of a vibration per second. The $\frac{1}{200}$ part of a tone can be distinguished by the trained ear. Other examples will be given under the separate senses.

It is this improvement in refinement that is what is aimed at in all training of the senses. The teacher should notice that in all sense-training the child is taught to distinguish wide differences at first, and the differences are gradually decreased until objects differing but slightly can be distinguished. Thus in kindergarten lessons on colour, white would first be distinguished from black, then from a dark grey, then from a light grey, and so on until different shades of grey could be distinguished.

The student should notice that the term "**sense-training**" is not a very appropriate one, as it is not the power of sensation that is trained, but the power of gaining knowledge from sensations, that is, *perception*. As already pointed out the faculties of sensation and perception are so intimately connected that they can be separated only by abstraction.

Sensations form the raw material out of which all our knowledge of the non-ego is manufactured.

Résumé.

I. The **Intellect** consists of :—

1. Sensation.
2. Perception.
3. Memory.
4. Imagination.
5. Conception.
6. Judgment.
7. Reasoning,

and these are separable only by abstraction.

II. **Sensation.**

1. Definition: A simple mental activity consequent upon the propagation of a nervous disturbance from the end of an afferent nerve to the cerebral hemispheres. There are three elements in a sensation.
   a. A physical stimulus.
   b. A physiological activity.
   c. A Psychological act, the latter only being the true sensation.
2. A sense-organ is a part of the body specially adapted for receiving stimuli and transmitting them to the brain.
3. Sensations may be discriminated:
   a. When obtained through different sense-organs, *e.g.*, a *sound* may be distinguished from a *light*, etc.
   b. When they come through the same sense-organ if they differ in—
      1. Intensity, 2. Duration, or 3. Quality.
4. Quality is whatever, other than intensity and duration, is possessed by sensations through the same sense-organ, enabling them to be mutually discriminated.
5. A sense is refined when capable of distinguishing minute differences in its sensations. The senses in order of refinement are :—
   a. Taste. *b*. Smell. *c*. Touch (including muscular sense). *d*. Hearing. *e*. Sight.
6. Sense Training is really *perception* training, for its object is to enable the pupil to *perceive* minute differences in his sensations.
7. Sensations are the raw material out of which all our knowledge of the outside world is elaborated.

CHAPTER VI.

SENSUOUS PERCEPTION.

Perception is the mental process by which we become aware of relations between our sensations, and infer a reason for such relations. Thus, when I look at the lamp before me, I experience a certain sensation, and I am further aware that this sensation is like many which I have before experienced, and which I know to have been caused by objects known as lamps, and I hence conclude that it is a lamp that is the cause of my present sensation—the whole process is called *perceiving* the lamp.

A more precise definition of perception is—*Perception is the mental process by which we connect a subjective sensation with an objective reality*. Thus, in the above example a certain subjective sensation, of sight, is connected with the objective reality, a lamp. By perception we interpret our sensations. The resulting mental product of any act of perception is called a **percept**. It is easy to see that perception involves memory, and partakes of the nature of inference. (See Chapters XI. and XVII.) Thus, at the present moment I have an auditory sensation which I perceive to be the tick of a clock. I perceive the clock from this sensation. I can perceive it because I *remember* that my clock has made a similar noise in past times, and I hence *infer* that it is a clock that is causing my present sensation. There are in every normal perceptive process an *objective* element and a *subjective* element.

1. **The objective element.**—This is some external object which is the cause of certain sensations by means of which such object is perceived. In normal perception the resulting percept has always as its immediate cause the corresponding real external object. Thus the lamp I see is really present before me. But this is not the whole of the matter. Why

should such sensations impress upon our minds the idea of an object? For this interpretation of our sensations another element is needed. This is—

2. **The subjective element**, or the activity of the mind itself.—As said above, every act of perception is of the nature of inference. It is, however, usually performed so automatically that we do not regard the process as one of inference. Not only does perception involve reasoning but the reasoning may be and often is wrong. Patients in the delirium of fever often perceive many things which do not exist outside of their fevered brains; and under the influence of keen feeling we are all apt to misinterpret our sensations. This is what Shakespeare means when he says:—

> "Or, in the night, imagining some fear,
> How easy is a bush supposed a bear."

When this is done certain *sensations* are caused by "a bush," but the wrong inference is made that they are caused by a "bear."

What we perceive is due almost as much to what the mind expects to receive as to what is imprinted on the senses. We see what we are prepared to see and hear what we are prepared to hear, as jugglers and ventriloquists know full well. This power of the intellect to interpret our sensations is the result of our previous experience, superimposed on certain innate capabilities; and hence the causes of the variation of this power in different individuals must be sought for partly in what the child already possesses at birth, and partly in the influences to which the child has been subjected.

The relative importance of these two factors is a matter of dispute. To the teacher the important thing is that the latter factor is one of vast influence. Hence the importance of subjecting the perceptual power of children to a systematic course of training. It is this training which should always be the first aim of the teacher in giving an **object lesson.** Object lessons were devised as a means of "training the senses," and the increased attention given to them in our schools may be regarded as an indication of the spirit of modern education, which is denoted by the (somewhat misleading) phrase—"Things not words." Examples of the vast improvement that results from training perception through the different senses will be given in the chapters on the special senses. The fact that we are able to *perceive* by retaining traces of past sensations and percepts is one of the greatest importance; it is the principle underlying the formation of habits. The saying, "I am a part of all I have seen" is intended to convey the same fact. Every experience we have, modifies us and leaves us different from what we were before it. The immense importance of the power of perception is evident. Without it the world would be a sealed book, no knowledge of it would be possible. On the other hand the more reliable we can make perception, the more useful does it become to us.

Résumé.

I. **Perception.**
  1. Definition: The mental process by which we connect a subjective sensation with an objective reality.
  2. By it we interpret our sensations.
  3. Perception involves *memory* and *reasoning*.
  4. Perception involves two elements.
    a. The *objective* element which consists of some object outside of ourselves, and which causes the sensation in us.
    b. The *subjective* element which is the activity of the mind itself, and therefore depends on the individuality of the percipient mind.

II. **Origin of perceptual power.**
  1. Innate capabilities—or the constitution of the mind at birth.
  2. Education, including not merely what we learn at school, but everything that influences.

III. **Training of perceptual power.**
  1. This is the chief aim in infant education.
  2. Object lessons were devised for this purpose.

IV. **Perception involves** a power on the part of the percipient of being modified by experience, which power also underlies the formation of habits.

CHAPTER VII.

THE SENSES.—*Smell, Taste, Touch, Temperature.*

Smell.—The skin lining the cavity of the nose is known as *mucous membrane*. Part of this, called the *olfactory region* (regio olfactoria), forms the organ of smell. Immediately beneath the mucous membrane of the olfactory region lie the ends of the *olfactory nerves* which are the special nerves of smell. These nerves go to the anterior basal part of the brain known as the *olfactory lobes*. The sensation of smell cannot be excited except through the stimulation of the olfactory nerves; to excite these nerves the stimulus must be in the gaseous form. If the nostrils be filled with a liquid (even *eau de Cologne*) there is no sense of smell. The organ of smell being placed at the entrance to the alimentary canal serves as a sentinel to warn of the approach of anything that is injurious.

It is well to remember that whatever we smell is in close contact with the olfactory region. Hence, such a thing as sewer gas, for instance, must have been more or less inhaled before it is perceived by the sense of smell. This sense is of little use intellectually. It gives us no knowledge of space relations (*e.g.*, size, shape, distance) and is therefore one of the *non-geometrical* senses. Let the student imagine himself lacking every sense but smell, and he will at once realise how slight is the knowledge of the world that can be given by this sense.

The sense of smell varies in delicacy very much in different individuals. The variation is largely due to differences in the amount of training to which the sense of smell is subjected, but not altogether. The sense of smell almost better than any other serves to show how important is the *subjective* element in our sense perceptions. There is hardly any smell, however filthy some may think it, but that others may be found to whom it is pleasant, and scents, which are usually regarded as pleasant, to some people are most objectionable. For instance, some people like the smell of paraffin, and some dislike the smell of *eau de Cologne.*

Taste.—The organs of taste are the *tongue* and the *palate*, the latter being of less importance than the former. The ends of the *nerves of taste* are spread out over the surface of the tongue and palate immediately beneath the skin or mucous membrane. These nerve-endings are in close connection with the small prominences (or *papillae* as they are called), spread over the surface of the tongue and palate. Taste can be excited only by bodies in a *liquid* state. When solids are tasted some of the solid is first dissolved in the saliva of the mouth. Any solid incapable of solution is incapable of exciting the sense of taste. For example, a piece of glass if put on the tongue will excite sensations of touch and temperature, but is quite tasteless.

All tastes may be classified into :—

a. Sour. *b*. Sweet. *c*. Salt. *d*. Bitter.

The sense of taste ranks low as an intellectual sense. It is, however, capable of greater refinement than is the sense of smell. In the case of the tea-taster and the wine-taster the discriminative power of this sense is developed to a very high degree of perfection. It is, however, like smell, a "non-geometrical" sense, and is of little importance from an intellectual point of view. Its use is to guard against the entrance into the alimentary canal of anything injurious to the body.

Touch, or the pressure sense.—For this sense there is no definite organ as in the case of most of the senses. The ends of the nerves of touch are located immediately below the skin. These nerve endings are not, however, uniformly distributed over the body surface. When they are more numerous the skin is more sensitive to pressure, and where they are altogether absent, as in the nails and hair of the body, there is no sensibility to pressure. The varying sensitiveness of the skin may be easily tested with a pair of dividers (compasses). If the points of the dividers are separated by only ·044 inches and applied to the tip of the tongue they will be felt as two distinct points; if pressed on the skin of the tip of the fingers, the points of the dividers must be separated twice as far in order to be perceived by the sense of touch as two distinct points. The tongue, the lips, and the finger tips are the parts of the body's surface endowed with the greatest sensitiveness to touch. This great sensitiveness is owing to the fact that the nerve-endings of touch are more numerous in these parts than anywhere else in the body. The finger tips may be regarded as the organ of this sense. If the dividers be applied to the middle of the back it will be found that the points must be more than ¼ inch apart to be felt as two. The distance of the divider points apart varies inversely as the local discrimination of the skin at the point. By *local discrimination* is meant the power of distinguishing sensations otherwise alike according to the part of the body at which the stimulus is applied. Tactual sensations admit also of discrimination according to their intensity. Under favorable circumstances a pressure of 14½ ozs. can be discriminated from one of 15 ozs.

The knowledge given by the sense of touch is much greater than that given by smell or taste. Touch, through its power of localising, is capable of giving considerable knowledge of space relations, as is seen in the case of persons born blind, who still manage to attain a considerable amount of knowledge of space relations; thus by touch they can learn something of the size and shape of bodies, although much knowledge of these is given by the *muscular* sense. By touch we learn also whether a body is rough or smooth. If the open hand be placed on a rough body the sensations resulting from the contact at different points will differ in intensity, and it is this variation in intensity that is interpreted to mean a roughness of the surface of the object.

Touch is an *intellectual* sense, a fact which depends on its susceptibility to great refinement in the discrimination of locality and intensity. Touch is the fundamental sense out of which all the others have probably been evolved. It is still the test sense. Whenever we see something whose real objective existence we have reason to doubt, we at once try to touch the apparent object, a proceeding which at once assures us of the existence or non-existence of the object. Sensations of touch form an important feature of our conscious life. Such sensations are constantly excited by the varying pressure of our clothes, etc.

The temperature sense.—The organ of this sense is the skin in which there are the ends of nerves whose specific function is the transmission of disturbance resulting from changes of temperature to the brain. More curious still, the nerves that convey impressions of cold are distinct from those that convey impressions of heat. The temperature sense is therefore really a "heat" sense and a "cold" sense. Some parts of the skin are sensitive only to heat (heat spots), others are sensitive only to cold (cold spots). The heat spots bear no constant relation to the cold spots in different parts of the skin. The temperature sense is non-geometrical, being incapable of giving space relation. We cannot, for instance, learn much (or anything) about the shape, size and distance of an object by means of temperature sensations to which it gives rise. The discriminative power of this sense is not very great. At moderate temperatures a change of about half a degree Fahrenheit can be perceived. Our perceptions of temperature are moreover in a great degree subjective. This can be illustrated by an experiment with three tumblers of water, one very hot, one lukewarm, and the third very cold. If the first finger of one hand be held for some time in the hot water, and the corresponding finger of the other hand be similarly held in the cold water, and the two be taken out and simultaneously put in the lukewarm water, to one finger this water seems *cold* and to the other *hot*. Hence the necessity of having some such instrument as the thermometer for the measurement of degrees of heat. The above experiment with the three tumblers of water may help to convince the student of the fact (a fact of which so many people obstinately refuse to be convinced) that our individual sense perceptions are unreliable.

Résumé.

I. **The sense of smell.**

1. *Organ.*—The mucous membrane of the part of the nasal cavity called *regio olfactoria.*
2. *Physical stimulus.*—This is matter in a gaseous form.
3. Incapable of great refinement and gives no knowledge of space relations or of resistance.
4. *Use.*—To act as a guard against the entrance of anything injurious to digestive system.

II. **Sense of taste.**

1. *Organ.*—The tongue and palate, the membrane of which covers the ends of the nerves of taste.
2. *Stimulus.*—Bodies in the liquid state.
3. *Classification* of taste:—*a* sour; *b* sweet; *c* salt; *d* bitter.
4. Taste is a non-geometrical sense, and is of little importance to the teacher, though capable of greater refinement than smell.
5. *Use.*—It acts, like smell, as a sentinel to warn of the approach of anything injurious to the alimentary canal.

III. **Touch, or pressure sense.**

1. *Organ.*—The nerve-endings scattered over the surface of the body, but are most numerous in tips of tongue, lips, and finger tips. The finger tips may be regarded as the organ of touch.
2. *Discriminative power.*—Capable of much greater refinement than smell or taste. They may be discriminated with regard to:—
   - *a. Duration,* as they have little persistence.
   - *b. Locality.*—This power of local discrimination varies greatly in different parts of the body. It is greatest in the tip of the tongue.
   - *c. Intensity.*—A pressure of 14½ ozs. can be distinguished from one of 15 ozs.
3. Touch is the fundamental sense out of which the others have been evolved. It is still the test sense.
4. Sensation of pressure forms an important part of our conscious life. The varying pressure of our clothes, for instance, must cause constant psychical changes.

IV. The temperature sense.

1. *Organ.*—The skin. The sense of temperature is distinct from the sense of touch.
    - *a. Heat-spots.* These are certain regions of the skin sensitive to *heat* only, *i.e.*, to temperatures higher than that of the body.
    - *b. Cold-spots.*—These are parts of skin sensitive only to temperatures below that of the body.
    - *c.* The heat-spots and cold-spots have their own specific nerves.
2. *Discriminative power.*—About half a degree Fahrenheit can at moderate temperatures be discriminated.

CHAPTER VIII.

THE SENSES—*continued.* THE MUSCULAR SENSE.

This sense was not until recent times clearly distinguished from the pressure sense, although more than 300 years ago at least two philosophers thought that our idea of resistance was gained through the power of movement, and not through the sense of touch. Later the pressure sense and the muscular sense were distinguished under the names *passive* and *active* touch.

The muscular sense is the power we possess of knowing whether the muscles of the body are contracted or not. The muscles are supplied with special nerves for the transmission of impressions of the muscular sense. Just as the eye is provided with nerves for the transmission of sight impressions. There is, of course, no organ of this sense other than the muscles themselves, which is probably the reason the sense itself was so long overlooked.

The student should clearly distinguish these two so closely connected senses, *touch*, and the *muscular* sense. If the open hand be laid on a table and a book be placed on the back of it, the sense of touch or pressure is alone excited; if now the book be raised the muscular sense is excited, giving an idea of strain or *effort* in the muscles of the arm. The heavier the book the more evident does this strain become. A feeling of effort is the essential characteristic of the exercise of the muscular sense, hence the name *active touch* sometimes given to it. Muscular sensations may be regarded as of two kinds:

1. Sensations of movement such as are experienced on moving a limb, and

2. Sensations of resistance such as are perceived whenever the movement of a limb is impeded, as for instance in trying to move a heavy object, the feeling that the free movement of the hand is resisted.

It is one of the most important of our senses intellectually. This depends on two things:

1. That its sensations admit of very exact discrimination, and
2. That the knowledge given by this sense is of the most important *kind*.

We have already seen that by touch alone a pressure of 14½ ozs. can be distinguished from one of 15 ozs., or (which is the same thing) a pressure of 29 ozs. from one of 30 ozs. If, however, the muscles be called into play by raising the object, a weight of 39 ozs. can be distinguished from one of 40 ozs.

Sensations of movement are susceptible of very exact discrimination with regard to their duration and with regard to local character. Sensations from one muscle being qualitatively different from those of another. The knowledge given by the muscular sense is knowledge of the most important kind.

Resistance.—This is revealed whenever we experience opposition to the free action of the muscles. The idea of resistance is fundamental in mechanics which is the science which treats of the action of *force* on bodies, and force can be measured only in terms of resistance.

Weight is a particular case of resistance. The weight of an object is the measure of the strain in the muscles necessary to prevent its falling to the earth. The pressure sense alone does not give us nearly so accurate a measure of weight as does the muscular sense. When I want to know if a letter weighs more than 1 oz. I balance it in my hand depending on the strain of the muscles to give me the necessary knowledge. Long practice gives a power of telling weight very exactly, as is seen in the case of letter sorters, who can almost infallibly tell if a letter is "overweight."

Hardness and softness are also particular cases of resistance.

Hardness is degree of resistance to change of form. That which offers great resistance to a change of shape is *hard*, and that which offers little is *soft*. Some knowledge of *roughness and smoothness* is given by the sense of touch alone, but the greater part of such knowledge is given by the varying *resistance* offered by surfaces to the passage of a hand or finger over them. To test the smoothness of a surface one naturally draws the hand or tip of the finger across it; if little or no resistance is experienced, we say it is *smooth*, if much resistance is felt we call it *rough*.

Some knowledge of *extension* or *distance* can be gained even by a blind man by means of muscular sensations of movement by reaching out his hand to touch or by walking to it. The ideas of distance given by sight are fundamentally ideas of the amount of muscular energy that would have to be expended to reach the distant objects. We still frequently express distance by the time required to cover it. *Shape* and *size* are merely particular cases of distance. When we know the *length*, *depth* and *breadth* (that is distance in three dimensions) of an object, we know both its shape and size.

Since knowledge of such great importance is given by the muscular sense, it is clear that in education great attention should be paid to its training. The training of this sense is begun in the cradle. As soon a child reaches out his hand towards an object or tries to grasp it, he begins to use this sense and acquire knowledge by it. The use of toys in the nursery is a most important means of muscular sense training; thus from the use of a box of bricks a child gains rudimentary ideas of most of the kinds of knowledge that can be gained by *touch* and the *muscular sense*, such as ideas of resistance, shape, size, extension, etc. In the kindergarten the muscular sense is trained by systematic exercise of the spontaneous activity of children.

Frœbel's "Gifts" form a series of objects intended to be so arranged as not only to satisfy the child's desire for playful activity, but also to call that activity into play in such a way as to lead the child to gain a series of ideas of an increasingly complex character. The object lesson when rightly managed is an excellent instrument for muscular sense training; and the same may be said of all branches of Science such as Chemistry, Botany, etc., that need for their study the manipulation of delicate apparatus. The object of all technical training in the school as distinct from the workshop is the training of this sense in such a way as to give *the power to use the fingers generally* rather than *the acquisition of skill of a special kind.* Learning to *write* and to *draw* consist largely in learning to control the power of the fingers, hand and arm. Women seem to be generally defter with their fingers than men, of which fact the explanation seems to be that they all go through a course of training of the muscular sense in learning to sew.

Résumé.

I. **The muscular sense** only recently distinguished from the sense of *touch.*

II. **Definition.**
- 1. The sense by which we know whether the muscles of the body are contracted or not.
- 2. Kinds of muscular sensations.
  - *a.* Sensation of free movement.
  - *b.* Sensations of resistance to movement.
- 3. The muscles have special nerves for the transmission of muscular-sense impressions,

III. **Its importance.**—This depends on the facts that:—
- 1. Its sensations admit of exact discrimination.
- 2. The knowledge given by it is of a most important kind.

IV. **Knowledge given by this sense.**
- 1. Resistance.
  - *a.* Weight. *b.* Hardness and softness. *c.* Roughness and smoothness.
- 2. Movement.
  - *a.* Extension or distance. *b.* Size. *c.* Shape.

V. **Means of training it.**
- 1. Nursery toys.
- 2. In the kindergarten.
  - *a.* Frœbel's gifts. *b.* Varied occupations.
- 3. Object lessons.
- 4. Writing and drawing.
- 5. Sewing.
- 6. Branches of science which involve practical work.
- 7. Technical work.

CHAPTER IX.

THE SENSES—*continued.*—HEARING.

The **organ** of hearing is the ear. This is a highly complicated instrument, which for the sake of description may be divided into three parts—the **outer,** the **middle,** and the **inner** ear.

The **outer ear** consists of three parts—the *helix*, the *concha*, and the *meatus*.

The *helix* is the part of the ear which projects from the sides of the head; the *concha* is the funnel-shaped hollow forming a depression in the side of the head; and the *meatus* is the passage from the *concha* to the middle ear.

The **middle ear** consists of the *tympanum* and its contents. These are the *tympanic membrane*, or "drum," and a chain of three bones crossing the cavity of the *tympanum*. These bones are called the *malleus*, the *incus*, and the *stapes*, from their likeness to a *hammer*, an *anvil*, and a *stirrup* respectively.

The *tympanic membrane* is stretched over the inner end of the *meatus*, and is a delicate, and at the same time, most important part of the ear. The *tympanum* of the ear is connected with the mouth by a small passage called the *Eustachian tube*. The **inner ear**, or *Labyrinth*, is the part of the ear in which are placed the auditory nerve endings. It may be regarded as made up of three parts—the *vestibule*, the *semi-circular canals*, and the *cochlea*.

The *vestibule* is the central cavity of the inner ear. The *vestibule* is of course in the bony part of the skull. This osseous cavity is partly filled by a lining membrane. Hence the *vestibule* is in a sense double, *osseous* and *membranous*. The other parts of the inner ear are similarly double.

The *semi-circular canals* are curiously-shaped osseous and membranous passages opening into the vestibule. The *cochlea* is the most complex part of the labyrinth. It is in shape somewhat like the shell of the common snail. The labyrinth is connected with the middle ear by two openings in the bone, which are, however, covered by a membrane. These openings are called *Fenestra Ovalis* and *Fenestra Rotunda* (see Fig. 3). The whole osseous labyrinth contains a fluid called the *perilymph*, and inside the membranous labyrinth is another fluid known as *Endolymph.*

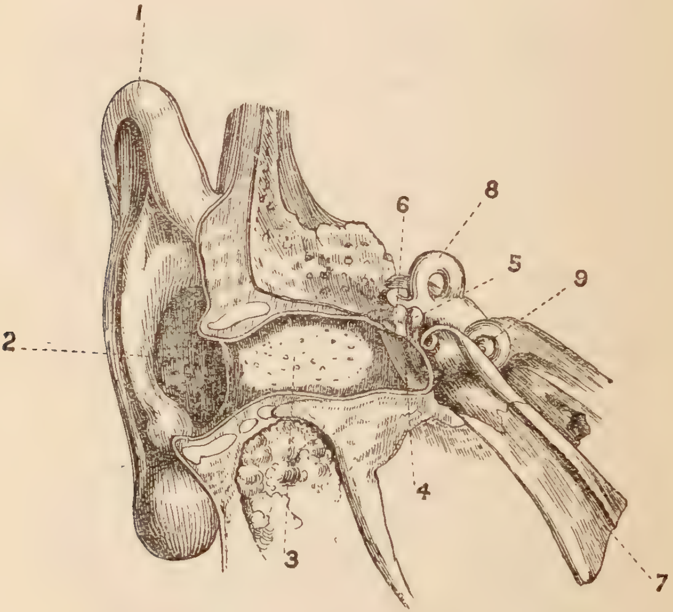


Fig. 3.—Section of Human Ear.

1. Helix. 2. Concha. 3. Meatus. 4. Tympanic membrane. 5. Malleus. 6. Incus. 7. Eustachian tube. 8. Semi-circular canals. 9. Cochlea.

The auditory nerve enters the inner ear through a small hole in the bone called the *internal meatus*, and then divides sending branches to the *vestibule*, the *semi-circular canals*, and the *cochlea*. This nerve must of course be stimulated before hearing can result. The physical stimulus of the auditory nerve is a wave motion of the air. These waves are condensed by the helix, and conducted by the concha and meatus to the tympanic membrane which, in consequence of the air particles impinging on it, begins to vibrate. The vibration of the drum is transmitted through the malleus, incus, and stapes, to the labyrinth, in which are the auditory nerve endings. These vibrations, provided they are of a certain intensity, and of certain rates, so act on the nerve as to excite the sensation of hearing. In order that the tympanic membrane should respond as readily as possible to feeble atmospheric waves, it is essential that the air on either side of it should be of the same density. Hence the use of the Eustachian tube, which connects the middle ear, through the mouth with the outside air.

The student should carefully notice that the air vibrations are not *sound*, nor are the vibrations of the tympanic membrane, or of any other part of the ear, nor even the disturbance (of whatever nature it may be) of the auditory nerve. Sound is a psychical phenomenon, consequent upon the propagation of such disturbance to the brain. If a gun is fired, and there is no mind sufficiently near to transform the consequent vibrations into sound, no *sound* is produced; what is produced is simply vibrations of the air particles.

All sounds are either *noises* or *musical sounds*. This is a psychical difference which depends on a difference of stimulus. When the *vibrations* are rhythmic, that is, when they recur regularly, the sound is a musical tone; when the vibrations are irregular, a *noise* is the result. All musical instruments are so made as to produce regular vibrations of some material substance. In the stringed instruments such vibrations are produced by drawing a bow over a tense string; in the piano, wires are set in vibration by being struck with leather-covered hammers; in the organ, as in all wind instruments, it is a column of air that is made to vibrate.

Sounds differ in *quality* with regard to *pitch* and *timbre*. Some sounds are shrill or high, others are bass or low; the quality involved in this distinction is what is called *pitch*. The pitch of a sound depends upon the rate of the vibration producing it. If this rate be *great* the sound is *high*, and if *small* the sound is *low*. Few people can hear a sound resulting from vibrations of less rapidity than 32 per second, and the majority cannot hear sound produced by more than about 20,000 vibrations per second, although some can hear sounds produced by as many as 40,000 or even 50,000 per second. Vibrations of from 32 to 32,000 per second represent about 10 octaves of sound. Two sets of vibrations, of which the rate of one is double that of the other, produce what is called an *octave* in music. The octave is a fixed interval in music, although the division of it into smaller intervals is to a certain extent arbitrary. Suppose eight strings be so arranged as to vibrate at the rates of 240, 270, 300, 320, 360, 400, 450, 480, the resulting sounds would be the *scale* of 8 sounds forming the octave as divided among civilised nations.

By the **timbre** (or "quality" as it is often called) of sounds, is meant that characteristic by which we can distinguish tones of the same pitch when produced by different instruments. Thus, the voices of different people are easily distinguishable, even when singing the "same" tones, that is, tones *of the same pitch*. So with the tones of different instruments. The middle C on a flute, for instance, is easily distinguishable from the same C on the violin. The physical cause of this lies in the fact that what we call *a* musical tone is not *one* but many. In such a sound there is a fundamental tone and several others of *higher* pitch, hence called *overtones*, mingling with it. It is the number and relative intensity of these overtones that decide the *timbre* of a musical tone. They may, in fact, be artificially arranged so as to imitate the particular *timbre* of any instrument, as is done in the case of the organ, in which there is often a stop, the *vox humana*, which produces tones having the characteristic timbre of the human voice. By *intensity* of a sound is meant its relative loudness or softness. Much of the pleasure derivable from music depends upon differences of intensity. *Expression* in music depends mainly upon intensity, and musicians make use of a large number of "marks of expression," ranging from *fortissimo* (very loud) to *pianissimo* (very soft).

The **duration** of sounds also plays a very important part in music. Although hearing is a non-geometrical sense, yet it ranks high in regard to intellectuality and refinement, and is of vast importance in the acquisition of knowledge

The ear possesses a marvellous power of discrimination in regard to **pitch.** The trained musician can distinguish more than 200 tones in the interval of a *major second*, that is, between the tones produced by two successive white keys of a piano. Though these can be distinguished, they cannot be sung. No one can sing less than quarter tones *in tune*. The musician also develops a wonderful power of distinguishing sounds by their timbre. The conductor of an orchestra can at will single out and follow the tones produced by any one instrument, and if any one of his performers plays a false note he at once singles out the offender.

With regard to **locality**, the ear possesses very little discriminative power. Anyone who has tried, knows how difficult it is to locate sound (*i.e.* tell where it is) by the ears alone. If the source of the sound be equidistant from either ear, hearing gives no idea at all of its whereabouts; but when it is nearer one ear than the other, the waves enter the one ear with greater force than they do the other, and thus a vague idea of the position of the sounding body is known. Hearing, however, possesses sufficient localising power to externalise sounds. We know nearly always whether a sound is in ourselves or not.

The above suggests reasons for training the sense of hearing. It is only the *trained* ear that distinguishes pitch and quality so precisely. The power of discriminating sounds by differences of pitch is marvellously developed by exercise. Many people who think they have no ear for music, might, by training, acquire a keen appreciation for musical intervals. The singing that is taught in schools at the present day, will do much to extinguish the non-musical ear. It is rare for a competent music-teacher of children to come across a child, who, from a musical point of view, is absolutely hopeless. To train children to appreciate good music is to reveal to them a world of æsthetic delight; and to train them to sing, or to play some instrument, is to give them something with which they can employ much of their leisure time in such a way as not only to keep themselves out of the reach of many temptations, but also to calm ruffled feelings, to improve the sense of grace and proportion, and to quicken the spirit, and to stir the imagination.

It should moreover be always borne in mind, that the best music of the great composers can no more be appreciated without some training, than can Hamlet without some training in literature.

On the appreciation of differences in articulate sounds, depends in the highest degree the power of learning the thoughts of others. This appreciation can be vastly improved in children by teaching them to read well.

Résumé.

I. **Organ of hearing.**—The ear.

1. *Outer Ear* consisting of:—
    - *a.* The *helix*, the part projecting from the head.
    - *b.* The *concha*, the funnel-shaped depression leading to
    - *c.* The *meatus* or narrow channel which terminates at the "drum."
2. *Middle Ear* or *Tympanum.*
    - *a.* The tympanic membrane.
    - *b.* The tympanic cavity.
    - *c.* A chain of three bones passing through the cavity, and called:—
        1. *Malleus*, from the Latin *Malleus* = hammer.
        2. *Incus*, " " " *Incus* = anvil.
        3. *Stapes*, " " " *Stapes* = stirrup.
3. *Inner Ear* or *Labyrinth* divided from the Middle Ear by the *fenestra ovalis* and the *fenestra rotunda.*
    - *a.* The *Vestibule* or anterior part.
    - *b.* The *semi-circular canals* and
    - *c.* The *Cochlea.*

II. **Stimulus.**—Always the vibrations of some material body, which are propagated through the air (generally) to the ear. The tympanic membrane takes up these vibrations which are then transmitted through the chain of bones to the Labyrinth, where they reach the auditory; the ensuing nerve disturbance is transmitted to the brain, and there is interpreted as sound.

III. **Classes of sounds.**

1. *Noises* resulting from *irregular* vibrations.
2. *Musical tones* resulting from *regular* vibrations.

IV. **Quality of sounds.**

1. Pitch depending on rate of vibration. If the rate of vibration of a sounding body be doubled, the octave is sounded. The range of appreciable sounds is about 10 octaves. The divisions of this range form the musical scale.
2. Timbre (or "Quality") or Klang is the characteristic by which one sound may be distinguished from others of the same pitch. Every musical instrument produces tones of a particular timbre. This depends on the number and relative intensities of the *overtones*.
3. The *intensity* and *duration* of sounds play an important part in music.

V. **Discriminative power of this sense.**

1. *Very great* with regard to *pitch*. In the middle of the scale $\frac{1}{200}$ of a musical tone can be distinguished by the trained ear. This power is greatly improved by cultivation.
2. *Very great* with regard to *timbre*—also greatly improved by practice.
3. *Very small* with regard to *locality*.

VI. **Reasons for training it.**

1. Training effects great improvement.
2. Opens a world of æsthetic delight.
3. Music affords a means of recreation that is of real use to the mind.
4. Some training necessary to fully appreciate articulate speech.

CHAPTER X.

THE SENSES—*continued.*—SIGHT.

The **organ of sight** is the eye. This is a bag or ball, called the eye-ball, which is almost a sphere in shape; the visible part, however, projects more than would the surface of a perfect sphere. In other words, the visible and smaller part of the eye-ball is a part of a sphere of smaller radius than that of which the invisible and greater part consists.

The eye consists of a **compound coat** or **bag** and its **contents.**

The coat of the eye comprises an **outer,** a **middle** and an **inner** layer.

The outer coat is very fibrous and tough, and is called the *sclerotic;* the sclerotic, where it is visible and transparent, is called the *cornea.* The middle layer in the wall of the eye-ball is called the *choroid.* This contains many blood vessels, and such a number of cells containing a dark brown pigment, as to give the layer a very dark, almost black appearance. Beneath the cornea the pigment of the cells of the choroid (here known as the *iris*) varies in different eyes. In the choroid under the centre of the cornea is an aperture of varying size called the *pupil*, to allow of the passage of light.

The innermost layer of the wall of the eye-ball is the *retina.* It is this retina that contains the endings of the nerves of sight,-that is, the element by means of which a physical activity is changed to a physiological one (nerve disturbance). The *optic* nerve enters the eye-ball a little within and below the point where the optic axis (see below) passes through the back of the ball. The retina may be regarded as the frayed out strands of this nerve. Some idea of its complexity will be gained by learning that although the retina is only about $\frac{1}{80}$ of an inch in thickness, it consists of 10 distinct layers; that the second of these (beginning from within the eye) consists of cylindrical and conical cells *(rods* and *cones)* which are so numerous, that at the *yellow spot* (where only cones appear) not less than 1,000,000 occur in $\frac{1}{100}$ sq. in. It is the layer of rods and cones that is mainly (or entirely) concerned in the change of ether vibrations to nerve commotions.

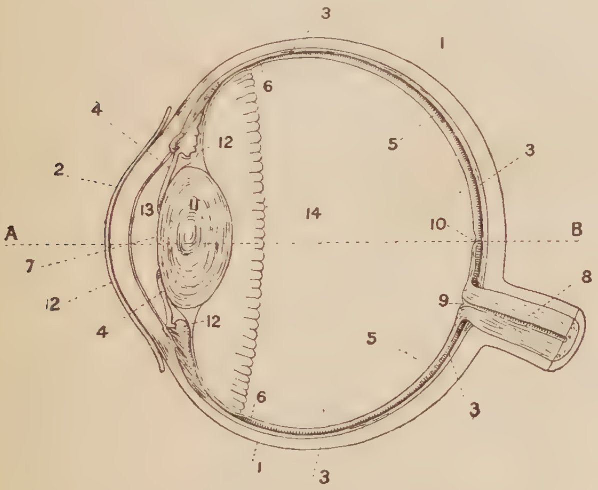


Fig. 4.—Diagram of Eye (magnified 2 diameters).

A B. Optic axis. 1. Sclerotic. 2. Cornea. 3. Choroid. 4. Iris. 5. Retina. 6. Limits of retina. 7. Pupil. 8. Optic nerve. 9. Blind spot. 10. Yellow spot. 11. Crystalline lens. 12. Suspensory muscles. 13. Anterior chambers with aqueous humour. 14. Posterior chamber with vitreous humour.

Just where the optic nerve leaves the eye-ball, the eye is insensible to light, hence the name "blind spot" given to this part of the retina. Near the blind spot is a slight depression in the retina called the "yellow spot" (*macula lutea*), which is the part of the retina most sensitive to light, or the place of most distinct vision.

The chief contents of the eye-ball are the **crystalline lens**, the **aqueous humour**, and the **vitreous humour**.

Immediately behind the pupil, and held in position by suspensory muscles is the crystalline lens. This is a double convex lens which brings the rays of light which pass through the pupil, to a focus on the retina. The space in front of the crystalline lens (the anterior chamber) is filled with a watery fluid called the *aqueous humour*; and the chamber posterior to the crystalline lens is filled with a more viscous liquid called the *vitreous humour*.

The eye may be regarded as an optical instrument for throwing images of objects on the retina, just as a magic lantern forms images on a screen; and as a lantern can be focused so as to cast a clear and distinct image on the screen, so the eye within certain limits, possesses a power of focusing itself, so as to form clear images on the retina. It should be noticed too, that the iris has the power of controlling to a large extent the size of the pupil, and thus regulating the amount of ether vibration that reaches the retina. Diffused through all space is (supposed to exist) a substance called ether, almost devoid of weight and possessed of great elasticity. The molecules of every luminous body are in a state of rapid vibration. These vibrations are taken up by the luminiferous ether, and propagated by it in all directions. When any of these ether vibrations of a particular rate pass through the pupil and impinge upon the retina, the sensation of vision results. It should be carefully noticed that ether vibrations are no more light, than are air vibrations sound. The ether vibrations impinge on the retina, and are there transformed into nerve disturbance, which the optic nerve transmits to the brain, and is there interpreted as *light*. Light, then, is a purely *psychical* phenomenon, though of course the sensation of light must be preceded by a physical and physiological activity. To be seen as distinctly as possible the image must fall on the yellow spot; the farther the retinal image is from this, the less distinctly is it perceived. The importance of this will be seen below.

Sight is the most refined of all the senses, and affords the means of acquiring far more knowledge than do all the other senses together.

The discriminative power of sight is very great, exceedingly small differences being perceptible by it.

The chief kinds of knowledge given by sight are knowledge:—1, of colour. 2, of movement. 3, of distance. 4, of shape and size, and 5, of position.

Colour is a purely optical phenomenon, that is, it is perceived by sight alone, unaided by any other sense. It is to the eye what *pitch* is to the ear, and just as there is a scale of sounds, so there is a scale of colours. Colour depends on the rate of vibration of the ether. Ether vibrations to be capable of causing sight sensations must be of greater rapidity than 370 billions per second, and of less than 900 billions per second.

Red, orange, yellow, green, blue, indigo, violet are the colours generally enumerated in the spectrum of the rainbow. Red is produced by the lowest rate of vibrations that affects the sense of sight, and violet by the highest. The division of the colour scale into seven colour tones is quite arbitrary. It is said that 230 distinct tints can be perceived in the colour range. Herschel thought that those who laid the mosaics of the Vatican must have distinguished 30,000 colour tones.

Colour discrimination depends largely on practice. Thus the artist can distinguish shades which are indistinguishable by most people, and it is said that Orientals can distinguish more shades of colour than Europeans. Many people show so defective a perception of colour as to be called *colour-blind.*

Movement.—The visual sensation caused by a moving object calls into play the *muscles* of the eye-ball. If a light be moved before the eyes, they are rotated so as to keep the image on the yellow spot, and it is the muscular effort involved in this rotation of the eye-ball, that gives us a much more precise idea of the motion than would otherwise be attainable. The perception of movement then, is effected by the combined activity of the *muscular* and *sight* sense. A single experiment will show that movement of the eye-ball is interpreted by the mind as objective movement. Let the student close one eye, and while looking steadily at a light with the other, move the eye-ball with his finger; the light instantly seems to move.

Movement can, however, be perceived even if the eye be fixed, for as an object moves across the field of view, the image will move in a contrary direction across the retina. Every new position of the image on the retina would be interpreted as a new position of the actual object.

Distance.—The perception of distance seems to be immediate. Most people would say they *see* the distance of objects. This, however is a mistake. The idea of distance is always the result of a judgment. If a child were born blind, and were to remain so till (say) the age of 20, and were then suddenly to open his eyes on an extensive landscape, everything in it would seem to be in vertical plane touching the face. The power to gain ideas of distance depends chiefly on the fact that vision is *binocular*, that is, with two eyes. When looking at a *distant* object, in order that the image in each eye may fall on the yellow spot, the axes of the two eyes must be parallel. If the object be made to gradually approach, each eye will always so turn as to make the image fall on its yellow spot; that is, their axes do not remain parallel, but will always meet in the object itself, and the nearer the object, the greater the angle between the axes. It is the muscular effort necessary to keep the eyes fixed on the object, that indicates to the mind the distance of the object. Hence the idea of distance is mainly the result of a judgment based on certain muscular sensations.

The difficulty of judging distance with *one* eye can easily be tested by trying to snuff a candle with one eye closed. Still, each eye has in itself a certain power of adjusting itself to objects at different distances. Adjustment always means muscular effort, which may be made the basis of a vague idea of distance. Of course people who are permanently deprived of the use of one eye, learn to make the most of any monocular indications of distance, but they never become able to judge distance so well as are people with two eyes.

Another indication of distance is the apparent size of an object, if we know the actual size. The apparent size, of course, depends on the size of the image on the retina. If I see a *man* who seems no bigger than a small doll, I instantly conclude he must be a long way off, for I know that he is bigger than a doll, and my experience has told me again and again, that the farther away an object is, the smaller it seems; hence I conclude that, the man to appear so small, must be a great distance away. A telescope magnifies the images of a distant object, and so makes it seem nearer; on looking through the telescope the wrong way, the image is diminished and at once seems farther off.

The apparent intensity of the light on an object is another indication of distance. The farther off a body is, the fainter it appears; hence if an object appears faint in the daylight we at once judge it to be far away. A curious consequence of this is the magnifying power of mist. In a mist an object appears very faint, and is thought therefore to be farther away than it really is. We at once conclude that the object must be so large as to appear the size it actually is when it is as far away as the mist leads us to think. But it would need a much bigger object at such a distance to appear the given size. Hence we instantly judge it to be so much bigger than it really is. Suppose for instance a sheep at a distance of twenty yards forms a retinal image of exactly the same size as that of a cow at a distance of two hundred yards; if on seeing the sheep when only twenty yards distant, some unusual circumstance makes it seem to be at a distance of two hundred yards, we instantly think the sheep as big as a cow, for the retinal image formed by it is of the same size as would be the retinal image of the cow at the greater distance under ordinary circumstances. Granted a retinal image of a certain size, the farther off we judge it to be, the bigger does it seem to be.

The perception of *shape* and *size* is clearly nothing but particular cases of the perception of distance. Shape depends on the relative distance of the parts of the object from us, and size on the difference between the distance of the extremities of the object from us.

The *position* or *situation* of an object is merely its distance from some known object or objects.

There are many evident reasons why the sense of sight should be trained. What is said above shows how great and how important is the knowledge that reaches the mind through the eye. There is scarcely a moment of our waking life when impressions are not being received by way of the eye—impressions moreover of the most valuable kind.

Moreover, impressions of sight are more easily remembered than are impressions of any other sense. Hence the rule in teaching: "Appeal to the eye whenever possible." A child will remember what he sees, much better than what he hears. It is a curious and interesting fact, that objects perceived through the other senses are generally visualised. On hearing a bell, we instantly form a *visual* image of it, notwithstanding the fact that our chief interest in it is its sound; so, too, of an object such as a *pear*; the name suggests to the mind the *appearance* of the object rather than its *taste*, although the latter forms our chief interest in it.

It is a fact deserving of notice, that we scarcely ever dream of *smelling* or *tasting*, rarely of *touching*, but more frequently of *hearing*, and most frequently of *seeing* objects. Our dreams are essentially *visions*.

Another reason for training the sense of sight is the fact that by training a vast improvement can be made in its discriminative power. When a sailor descries a sail so far off that it is invisible to the landsman, an image of the sail is formed on the retina of the landsman as distinctly as on that of the sailor; the difference is simply that the sailor *can* discriminate the speck on the retina representing the sail, from the rest of the retinal image, and the landsman *cannot*—a difference evidently due to training.

The teacher has within his reach many means of training the sense of sight of his scholars. In learning to read the sense of sight is greatly exercised. The child has first to learn to discriminate one symbol from others, and then gradually increase the number of symbols that he can discriminate, and finally learn to discriminate complexes of these symbols when combined in various ways. In *modelling* and *drawing*, too, the child has to learn to distinguish smaller and smaller differences between what he is trying to copy, and the results of his efforts.

Object lessons form a most important means of training the sense of sight if rightly carried out. Teachers, however, often give lessons about objects and think they are giving *object lessons*, when they are doing nothing of the kind. In an object lesson, the *object itself* must give information about *itself*. It must be made to appeal to the senses of the children, especially the sense of sight. *Rightly directed practice* is training, and is all that is needed to develop the power of sense-perception. Hence, if the teacher can only make his class use their eyes aright on the object from which the lesson is given, he can do all that is needed for training the sense of sight.

Elementary science when properly taught is a further development of the object lesson, and is of all things the most essential to effective eye training. The child that is taught to take an intelligent interest in some of the phenomena of nature in the midst of which he lives, is given the greatest possible stimulus to observe such phenomena. The child who is taught something of botany, or geology, or entomology, cannot but be constantly using his eyes in the observation of the objects of interest whenever he is out of doors, and, if he forms a collection of objects, as every child should do, frequently when in-doors.

Résumé.

I. **The Eye** consists of a *complex coat* and its *contents*.
  1. The *coat* of the eye consists of three layers.
    a. *Sclerotic*—the outer coat. This is opaque, except in front, where it is transparent, and called the *cornea*.
    b. *Choroid*—the middle coat. This contains—
      1. Many blood vessels.
      2. Pigment cells containing a dark pigment, except in the visible part (the *iris*), where the colour varies in different individuals.
    c. *Retina*—the inner coat. This contains the organs of sight. Its fibres unite and pass to the brain in the optic nerve. Where the fibres join to form the optic nerve is the *blind spot*.
  2. The chief contents of the eye are—
    a. *Crystalline lens* — This is a double convex lens immediately behind the *iris*, closing the *pupil* and held in position by suspensory muscles.

- *b. Aqueous humour*—occupying the anterior chamber in front of the *iris*.
- *c. Vitreous humour*—occupying the posterior chamber between crystalline lens and retina.

II. **Physical Stimulus** is ether vibrations, transmitted in wave form till they impinge on the retina, where they are transformed to nerve disturbance, which, when propagated to the brain arouses the sensation of sight.

III. Knowledge given by sight.

1. *Colour*—purely optical. Scale of colour from red to violet due to vibrations of from 370 billions to 900 billions per second. Discrimination of colour depends largely upon practice.
2. *Movement*, given mainly by muscles of eye-ball. The retina, if motionless, could, owing to its local discrimination, give some knowledge of movement.
3. *Distance*.
   - *a*. Its perception is not immediate, but a judgment.
   - *b*. This judgment depends mainly on binocular vision, and is based on the degree of tension of the muscles of the eye-ball in focusing the image on the yellow spot.
   - *c*. *Apparent size*, when real size is known, enables an estimate of distance to be formed.
   - *d*. Another help is the intensity of the light reflected from the object.
4. *Shape* and *size* are particular cases of distance.
5. *Position* is also nothing but relative distance.

IV. Reasons for training the sense of sight.

1. Training greatly increases its efficiency.
2. Knowledge obtained through the eye is very important.
3. Impressions of sight are deeper and more lasting than than those of any other sense.

V. Means of training.

1. Reading.
2. Modelling and drawing.
3. Object lessons; not mere lessons on objects.
4. Elementary science; especially botany.

CHAPTER XI.

MEMORY.

We have already seen that *sensations* usually result in *percepts*, and further, that every percept involves traces of previous impressions. These traces of previous impressions are, however, implicit; they are never made explicit by being consciously recalled and may therefore be spoken of as *sub-conscious*. The process by which we recall into consciousness previous percepts or ideas is called *recollection*. The term *reminiscence* is sometimes used as a synonym of *recollection*. Now, it is evident that in order that a percept may be capable of being revived in consciousness, the mind must retain some hold upon it. This retaining power is a necessary and evident condition of all recollection. Memory then consists of *retention* and *recollection*—*retention* being the sleep of images and ideas, and *recollection* their waking.

A good memory implies a strong retentive power and a readiness in recalling. That these are not always found together is a matter of common experience with every teacher. Some children have tenacious memories; once they have got hold of an idea, it remains; their retentive power is good. Among such there are frequently found some who cannot readily recall the ideas they have. Ask them a question suddenly and they are not ready with the answer, even though they have the knowledge necessary for fully answering it. Their *retention* is good, their *recollection* bad. They are like shopkeepers who have large supplies of goods so stored that they cannot readily get at them. On the other hand, some have great difficulty in fixing an idea, but once fixed, such idea is always easily recalled whenever needed. Such have good recollective power, and are often spoken of as *quick* or *ready-witted*. It is an old observation that the *ready-witted* are often shallow, Persons having poor retentive but good recollective power are like shopkeepers whose stock-in-trade is small, but what they do have is ready to hand.

Another characteristic of a *good* memory is that the actual acquisition of facts gives little trouble. The ease or difficulty with which facts can be fixed depends largely upon the power of controlling the attention (see Chap. XXII).

One other point should be noticed in a good memory. It is not enough to retain and recall. The revived images must be accurate copies of the original percepts. Revived images may be inaccurate, owing to several causes. The chief of these is the imperfection of the percepts at the outset, due often to a lack of careful observation. The more carefully we observe, the better we remember, for the resulting percept stands out in the mind more clearly marked off from other percepts. Visual percepts are the most rememberable of all our percepts for a similar reason, because sight is the most discriminative of all our senses, and gives us, therefore, more clearly-defined percepts. Even though a percept be perfect, yet owing to the imperfection of the memory itself the revived image may, and often will, be very imperfect. The memory capacity of no one is infinite, or even equal to the task of recording every human experience. Hence the continual acquisition of new knowledge must tend to totally or partially obliterate some of the old. The individual characteristics of percepts soon begin to disappear, leaving nothing but a hazy idea in the place of a well-defined percept.

Some people have been gifted with a prodigious memory. Here are a few instances. Macaulay discovered that he could repeat the greater part of "Paradise Lost" without ever having tried to learn it by heart. Mozart's memory was perhaps the most wonderful of its kind the world has seen. When in Rome, he is said to have heard in the Sistine Chapel a celebrated Miserere by Allegri, and to have carried the whole of it in his memory till he reached the house where he was staying, and then to have written it out absolutely correctly. Gustave Doré and Horace

Vernet are both said to have been able, after having carefully scanned the face of a person in the street, to go home and paint an accurate portrait of him. La Motte, on hearing Molière read one of his plays, is said to have immediately accused the latter of plagiarism, and to establish his accusation, repeated correctly a scene from the play just read. This he had remembered from hearing it read once.

It has been customary in past times to greatly over-estimate the importance of memory in education. A great memory was regarded as a sure sign of a highly educated man. It is, however, true that unusual powers of memory are not always accompanied with a corresponding power of general intellectual capacity. In fact an abnormal power of memory is apt to hinder the full development of the thinking powers ; for he who is gifted with a great memory, will often use his memory in cases where others would have to make use of their *reasoning* power. Further, the over-development of one faculty generally means the under-development of others. A great memory must not however be regarded as incompatible with great general intellectual power, though it should never be regarded as proof of it.

The invention of printing did much to diminish the importance of great memory power. No invention, however, can ever do away with its vast importance, as it is the retentive faculty that makes knowledge possible. Unless we possessed some power of retaining traces of impressions we should never be able to *recognise* anything, and without a power of recognition knowledge would evidently be out of the question.

Our modern education is apt to under-estimate the importance of memory. In a perfect system of education every faculty would be trained in exact proportion to its importance, and hence reasoning being the most important of our intellectual faculties, should receive the lion's share of training. What brought memory into disrepute was the over-importance attached to it. *To know* and *to know by heart* were regarded as synonyms. Montaigne is nearer the truth when he says "to know by heart is not to know at all." A parrot does not know, that is, does not *understand* a definition (say) because it knows it by heart. It is the merely verbal memory that is of little importance. "It is not enough," says a writer on Education, "that the mind can reproduce just what it has received, and no more; it must reproduce it *digested*, *altered*, *improved*, and *refined*." Children should not be expected to show what they have learned, by an exact reproduction of it. "Sheep," says Epictetus, "do not show the shepherd how much they have eaten by producing the *grass itself*, but by producing outwardly *wool* and *milk*, after their pasture is inwardly digested."

There are, however, certain things which children should be made to learn by heart. What these are, must be settled by considering what verbal knowledge will afterwards be of sufficient use to repay for the time and trouble spent in acquiring it. The question of *training* hardly enters into the question. A child's verbal memory may be trained by setting him to learn the names of the people who live in a long street, or by learning the names of all the villages in England. This is not done, however, because the usefulness of the knowledge acquired would be quite incommensurate with the time and trouble spent in acquiring it. On the other hand, children are made to learn the multiplication table by heart, not for the memory training involved, but for the great and frequent use to which such knowledge is put.

On this subject Sir Joshua Fitch writes:—"Shall I learn the number of yards in a mile, the formula for the square of $a+b$, or the trigonometrical expression for the area of a triangle in terms of its sides? Yes; for these are central and most serviceable truths, constantly wanted in the solution of problems, and often wanted in a hurry. Will it be well to learn the logarithm of all numbers up to 100, the number of pints in a hogshead, or the number of inches in a Flemish ell? No; I think I will not encumber my memory with facts so seldom wanted, so little known outside of a schoolroom, and so very easy to find, if by chance there should be any occasional need for them. Shall I set my pupils to learn by heart an extract from Scott's 'Marmion'? Well, I think not. For it is not likely to have any unity of its own. It is a fragment of a longer narrative, and is unintelligible without the rest; and since it is unreasonable to expect that the rest will be remembered, the fragment will soon drop out of recollection altogether. Shall I set him to learn part of 'Goldsmith's Traveller,' or 'Gray's Elegy,' or Wordsworth's 'Ode on Immortality? 'Yes; for every couplet here is a picture or thought in itself. Any one line will help to recall the lines related to it; and even if it does not do so, it has a value and suggestiveness of its own. Shall I learn the dates of the English kings, the latitude of London, and at least approximately, the size of the island and the population of its five or six largest towns? Yes, because England is my home, because it interests me more than any other place in the world, and because all these facts will be useful as fixed points of comparison round which all my constantly increasing acquaintance with it and its history, and with other places, will cluster and arrange itself. Shall I learn the Creed, the Lord's Prayer, and the Ten Commandments, by heart? Well—assuming of course that I accept them as true representations of my faith and duty—certainly. For they are venerable formularies which come to us with very sacred associations, and with a great weight of authority. They have shaped the conduct and guided the devotions of my Christian forefathers for centuries, and they are presumably expressed in the choicest, tersest and most weighty words, which tradition has been able to bestow upon us.*"

In the case of a large number of facts that we require only occasionally, it is enough to know where to find them. We want what has been aptly called an *index-memory*. This is one of the points brought out in the definition of an educated man as "one who knows what he knows, knows what he does not know, and knows where to find what he does not know."

Résumé.

I. **Memory** is implicit in every act of *perception*.

II. **Memory** is not a single faculty. It consists of:—

1. Retentive power—retention.
2. Reproductive faculty—recollection.

---

* Lectures on Teaching by Sir Joshua Fitch. Every teacher should read Lecture V., from which this extract is taken.

III. **A good memory** involves :—

1. Ready acquisition.
2. Strong retentive power.
3. Good recollection.
4. Power to retain and revive *accurate* images. Revived images may be inaccurate owing to many causes, among which are :—
    - *a.* Imperfection of percept from lack of careful observation.
    - *b.* Imperfection of memory itself.—No memory is infinite in capacity, and hence the acquisition of new, often means the forgetting of old knowledge.

IV. **Examples of persons with great memory power.**

1. Macaulay—able to repeat most of Paradise Lost without any effort to learn it.
2. Mozart—wrote down correctly a *Miserere* after hearing it once.
3. Gustave Doré and Horace Vernet—able to paint portraits from memory.
4. La Motte—repeated a scene of one of Moliére's plays on having heard it read once.

V. **Value of memory.**

1. Formerly over-estimated—especially in education.
2. Now liable to be under-estimated.
3. Its importance is great, as without retention no knowledge would be possible.
4. The verbal memory not so important—the important thing is to reproduce what we learn in a "*digested, altered, improved*, and *refined*" form.

VI. **What should be learned by heart?**

This question to be answered by considering the usefulness of the knowledge learned. Will the utility of the acquisition repay for the time and trouble spent in acquiring it, is the question.

CHAPTER XII.

MEMORY—*continued.*—ASSOCIATION OF IDEAS.

We have already seen that revivals of many impressions are implicitly present in every percept—that a percept would be an impossibility were it not that a present impression is associated with (*mostly subconscious*) ideas of previous *similar* impressions. These various impressions concerned in every act of perception, although very similar, are not identical with one another, or at least they were not caused by the same sensations. No two oranges, for instance, are exactly alike, nor even is the same orange exactly alike, at different times; and the *sensations* produced by the two, or the one at different times, must be different. Hence in every percept there is a close *bond*, *connection* or *association*, between a number of simple ideas the distinguishing features in each case being the great similarity between a present impression and the subconscious traces of previous similar impressions.

Association of Ideas is by no means restricted to acts of perception, but plays a most extensive and important part in all our intellectual life. Not only is there an association between widely different ideas, in virtue of some small likeness of some kind or other, but ideas are often associated together because of the contrast between them.

The explanation of Association of Ideas is most probably a physiological one, depending on the establishment of connections between different parts of the brain. The association is only a particular case of the formation of *habit*. (See Chapter XXIII on *Habit*.)

Association of Ideas is not a very accurate phrase, as what is meant by it is rather a direct association between the *objects* corresponding to the ideas, or else between *Brain processes*, the ideas being connected only indirectly. The student should understand the term to mean *that connection of whatever kind it may be, between two (or more) ideas in virtue of which the presence of any one in consciousness tends more or less strongly to call up the other (or others).*

The chief kinds of associations may be classed as

1. **Associations of Contiguity,**
2. **Associations of Similarity, and**
3. **Associations of Contrast.**

By an **Association of Contiguity,** is meant any bond between ideas arising from some *connection* of the corresponding objects in *space* or *time*. Here are a few examples of association by *contiguity in space.* We connect sand, shells, etc., with the sea-shore; school with lessons; Windsor with the Queen; our homes with many pleasures; persons with the places where we frequently meet them; and very closely an accident we may have witnessed, with the place where it happened. This association of *place* is wide-reaching and often very close; it was the first kind to force itself on the notice of observers. In one of Cicero's books he makes the characters take a walk in the Academy at Athens, where Plato had previously taught, and he makes one of them say:—"I know not whether it be a natural feeling, or an illusion of the imagination founded on habit, that we are more profoundly affected by the sight of those places which have been much frequented by illustrious men, than when we either listen to the recital or read the detail of the great actions. At this moment I feel strongly that emotion which I speak of. I see before me the perfect form of Plato, who was wont to dispute in this very place; these gardens not only recall him to memory, but present his very person to my senses. I fancy to myself that here stood Speusippus; there Xenocrates, and here, on this bench, sat his disciple Polemo. To me our ancient Senate-house seems peopled with the like visionary forms; for often when I enter it, the shades of Scipio, of Cato, and of Lœlius, and in particular, of my venerable grandfather, rise to my imagination. In short, such is the effect of local situation in recalling associated ideas to the mind, that it is not without reason, some philosophers have founded on this principle a species of artificial memory."*

Associations of **contiguity in time** are of even greater importance than those of contiguity in space. Thus the association between *summer* and *heat*, *autumn* and *harvest*, *winter* and *cold*, a *certain hour* with the *postman's knock* are examples; as are also the associations between our various meals and certain times of the day; in fact, nearly all the routine of life is based on this kind of association. The connection between *cause* and *effect* comes also under this heading, for the relation between them is made known by a sequence in time. Causal associations among ideas is characteristic of the adult and more highly developed intellect, although they appear in almost every one. Thus a child pats a strange dog and is bitten. On seeing another dog some time after the idea of patting it comes into his mind; but he does not pat it, for the idea of doing so instantly calls up the idea of being bitten. In the adult mind the connection becomes so strong, that a new phenomenon is scarcely ever perceived without some curiosity being felt as to its cause. An acquaintance dies, and straightway we wonder what was the cause of his death; a ship sinks and we wonder why. The teacher should do all in his power to strengthen these associations.

Another kind of association of ideas is worthy of special notice, namely **the intimate relation existing between written words and the sounds they symbolize, and further between spoken words and the ideas for which they stand.** The association in this case is so close that the *suggesting* idea immediately disappears and the *suggested* idea monopolises the mind. Thus when I see the symbol LONDON, I do not think what a curious symbol it is, nor am I likely to think of the sound, but I instantly have an idea of the place itself called up into my mind. Such associations must be acquired, and they serve to show how close connections may be made by long practice. A child sees a certain animal, and at the same time he is told that it is called a *cat*. After this he associates the word with the animal, but he cannot yet associate the symbols c-a-t with the sound. By dint of many repetitions a firm association is formed between the visual signs c-a-t and the sound kăt. Finally he learns to associate the animal itself directly with the visual symbol *cat*, without consciously passing through the spoken symbol. The association between a symbol and its corresponding idea may be regarded as one of contiguity in time, for a child sees a particular animal and is told that it is called a dog; the visual impression and the corresponding sound thus forming a close sequence in time.

---

* Cicero *De Finibus*, quoted by Dugald Stewart.

Ideas are also very frequently connected together, owing to some **similarity existing among the corresponding objects.** Thus, on looking at the portrait of a friend, the image of the original is instantly called up, and we proceed to compare the visual impression with the recalled image of our friend. It is the *similarity* between the portrait and the original that recalls the image of the latter to our mind. It is a common occurrence to hear people say, "That reminds me of such a thing"; "He reminds me of so-and-so." Every metaphor is based originally upon association of ideas on the ground of some similarity. The likeness existing between the way in which a ship cleaves its way through water, and that in which a plough goes through land, must have struck him who was the first to speak of a ship *ploughing* the sea. All classification is based on association through similarities. To classify is to arrange those objects which are alike in certain respects in a class, from which are excluded all objects differing in these respects. Thus all animals possessed of a backbone are put into one class and called vertebrates. So strong is the suggestion from similarity that it has been called "*the attraction of similars.*"

Association of Similarity is well marked off from that of contiguity. The latter arises from a close connection in time or space, while the former is more or less independent of time and space. An object seen to-day may remind us of a similar object seen years ago; and one seen here may remind us of one seen at the other side of the world. Finally, ideas are not unfrequently connected together by their *unlikeness*. Thus, *poverty* is suggestive of *wealth; heat* suggests *cold;* black, white; summer, winter, &c. In fact, an idea is not clearly understood unless it be placed in vivid **contrast** with its opposite. "We never know our blessings until we lose them" as the old saying has it. He who does not know what ill-health is, does not know what good health is. The one is fully realised only by contrasting it with the other.

The associations we have discussed so far are mostly of the simple kind, in which one idea is associated with another; but it is evident that ideas are often connected in ways much more complex. Thus, the visual symbol *air* is associated with the *atmosphere*, with a *melody*, and with one's *appearance*; the corresponding sound being also associated with a person who will on the death of another come into some property. The name of a place with which we are familiar has generally many associations, as any one can easily test by thinking of a particular place on different occasions, and noting the ideas suggested. Many ideas are connected in series, *e.g.*, the letters of the alphabet, the intervals of a tune, the words of a poem, the ideas received from the successive impressions in taking a well-known walk.

The first of these (the letters of the alphabet) serves to illustrate the fact that when a number of ideas are connected in a series, it is nearly always in a definite order. It requires quite an effort to repeat the alphabet backwards, unless we have previously learned it so. Let the student think of any well-known tune (*e.g.*, God save the Queen) and try to sing it backwards, and he will at once experience the difficulty in altering the order of connected ideas. This is evidently a question of habit. If we have perceived the series A, B, C a thousand times (say), and the series C, B, A not once, it is clear that A will suggest B, but will not be suggested by it, for B has so many times led on to C.

Since one subject may resemble in different ways many others it follows that one idea may be (and generally is) associated with many others. Thus the word *orange* may suggest something *yellow*, something *sweet*, the *earth* (from shape) and so on. This is an example of complex association of Similarity. Associations of contiguity may also be complex, since many different ideas may enter the mind contiguously in space or time.

The strength of the bond between two ideas may be measured by the greater or less certainty with which one idea will suggest the other connected with it. If the idea A invariably and immediately suggests the idea B, the bond of association between A and B is a strong one. It is important (especially for the teacher) to note on what a strong association between two ideas depends. It depends on two things—**interest and repetition.**

If at first we have our interest in the connection between two ideas strongly roused, such connection is almost sure to be remembered, that is, the one idea is almost sure to recall the other. Thus one who has once heard the peculiar rattle of the American rattlesnake, and immediately after has been bitten by it, will on again hearing the rattle, be certain to have vividly recalled to his mind, ideas both of the appearance and of the bite of the reptile. The survivors of the crew and passengers of the Drummond Castle will, as long as they retain their mental faculties, never hear the name "Drummond Castle" without having their terrible experience consequent upon the foundering of that vessel, vividly brought to mind.

Where such keen interest is lacking, frequent repetition will form the necessary bond between two ideas. This is well illustrated by verbal associations. By many repetitions, the connection between a visual symbol and the idea it is intended to represent, becomes so strong, that the symbol invariably calls up the idea.

Résumé.

I. **Association of Ideas.**

1. *Definition.*—That connection between two or more ideas in virtue of which, the presence of any one in consciousness tends to recall the others.
2. Perception is based on such association of ideas which is, however, not *explicit.*
3. Associations probably due to the formation of nervous paths in the brain.

II. Kinds of Associations.

1. *Contiguity.*—Arising from juxta-position in time or space. Associations of cause and effect and verbal associations come under this head.
2. *Similarity.*—The association between ideas arising from some likeness in the corresponding objects.
3. *Contrast.*—The association between an idea and its opposite.

III. Compound Associations.

1. Association of ideas in series, as in the alphabet. These are associated in a definite order.
2. Complex Associations, by which one idea is associated with various others in different ways.

IV. Strength of Bond of Association depends:—

1. On *Interest*, and consequent attention to the association.
2. On repetition.

CHAPTER XIII.

Memory—*continued.*

The importance of a knowledge of association of ideas lies in this—that whatever we may *retain* we probably never *recollect* anything unless it be suggested by something else associated with it. The recollecting of a retained idea is not, as everyone knows, always under the control of the *will.* When we wish to recollect any fact, all we can do is to put ourselves into such a frame of mind that such an idea is likely to be suggested by some associated idea.

If an idea can be recalled only through its associations with some other idea, it is evident that the greater the number of ideas with which any given idea is associated, the greater the likelihood of its recall. The idea of *home* is closely connected with other ideas whose name is legion, hence the frequency with which the idea of home is recalled. This shows the great importance in teaching, **of forming as many bonds of association as possible** to every fact we teach. "Each of its associates becomes a hook to which it hangs, a means to fish it up by when sunk beneath the surface," as Professor James puts it. Hence, too, to develop a good memory is to get into the habit of forming as many associations as possible with every new acquisition. But *associations* are nothing but *relations* between ideas, and all thinking consists in the consideration of relations between simple or complex ideas. If, then, a fact be well thought about, it is almost sure to be remembered. The viciousness of cramming lies in the fact that numerous facts are crowded into the mind in such a short time that it is impossible to form many associations with all of them.

It is worth noting that in trying to recall a certain idea, we may be led away from it by the presence of numerous associations on the brain. Thus, suppose *a*, *b*, *c* represent three associated ideas, and suppose *z* represent another idea directly associated with *b*; further, that A, B, C, Z, stand for the parts of the brain whose activity produces these ideas respectively. We wish to recollect *c*; if A be active, *a* comes into mind; the activity of A is associated with and leads to the activity of B, producing idea b; now to lead on to *c*, the activity of B should cause the activity of C, but instead of doing so, it may rouse the activity of Z, another one of its associates, causing *z* to rize in the mind, and so lead altogether away from *c* for which we are searching. This is where the *will* is concerned in an act of recollection. As soon as *z* rises in the mind, we know we are not on the right track, and cease, therefore, by an act of *will* to *attend* to *z*, but at once go back until we find another track which we try in the same way. Trying to *recollect* is like hunting for some material object in our houses. We do not know exactly where it is, but we know its whereabouts, *e. g.*, we may know the particular room in which it is lost. So we straightway go into that room, and begin to remove things one by one which are most likely to conceal it. It is impossible to put our hands immediately and directly on it by mere determination to do so. We must keep on removing object after object until the missing article is suddenly revealed. The analogy goes even farther yet. For we often fail to find the desired object even by the most careful search, and then some time after, when we are not looking for it, there it is suddenly before us; and further, such discovery is often due to the work done while searching for it. To search mentally for an idea is a precisely similar process, with a similar result. The idea is sometimes found during the search, never directly: sometimes after the search is ended, its discovery even then being often in consequence of such search, but never is it found immediately and directly.

It is always discovered in such cases by the mind being led to it along a track through some of its associates. Frequently, however, we cannot recall the idea wanted, and then after a time when not thinking about it, suddenly it flashes in consciousness. In such cases the recovery is generally (not always) due to the brain processes put into action by the search.

We have just seen that in order that a new acquisition should have a good chance of being retained and recollected, it should be connected by as many bonds of association as possible with ideas previously possessed. It is of importance then for the teacher to consider under what conditions these associations may be formed in the minds of pupils.

The two factors in the fixation of an idea are the *interest* roused in it, and the *number of times it is repeated.*

Interest has such a fixing power that an experience that occurs but once may be indelibly fixed on our minds. It makes but little difference so far as retention is concerned, whether the interest be of an extremely *pleasurable* or of an extremely *painful* kind. Thus, anyone who has had a narrow escape from being burned to death is almost sure to retain a vivid impression of the whole experience as long as he lives. Many single painful experiences we would forget but cannot.

Hence the teacher should do his utmost to raise the interest of the children in what he tries to teach them. With young children the interest must be direct,—in the subject itself. The successful infants' teacher is the one who can interest them directly in what they are doing. Infants are too weak in futurity to have any indirect interest in the subject; they cannot, for example, do anything to-day from the expectation of its being of service to them in years to come. This is just what older children and adults can and will do. They can take an interest in a subject which is in itself distasteful, because they know that the knowledge of such subject will prove beneficial to them in the future. As we grow older, up to a certain age, we live more and more in the future, and our interests have therefore more and more reference to the future.

It is evident, however, that the teacher has no chance of making all he teaches so interesting, that it will once for all be permanently fixed. Hence the necessity of repetition. Every presentation, however slight the interest may be, will make some impression, and if the presentation be repeated a sufficient number of times at sufficiently small intervals of time, the impression by a summation of effects, becomes so deep as to be permanently fixed. Every conscious fact of our existence is the result of some interest, and granted a sufficient number of repetitions, the sum of interest is great enough to effect permanent fixation. The Jesuits' maxim *Repetitio mater est studiorum* (repetition is the mother of studies), and Jacotot's maxim *Répétez sans cesse* (repeat unceasingly), both emphasise the importance of repetition in teaching. Hence the importance to the teacher of reviewing, revising, and recapitulating the work done. Every review will do something towards the fixing of the facts which the teacher wishes to be remembered.

From the above it is clear that the amount of *repetition* necessary, is inversely proportional to the *interest* roused in the work—the greater the interest excited the less the repetition needed ; the less the interest excited the more the repetition necessary.

It is often asserted that the memory can be vastly improved by practice. Now if, as seems highly probable, our retentive power depends on the degree of plasticity of the brain, that is, on the greater or less readiness with which it allows of the establishment of tracks for nervous discharge between its different parts, then our general retentive power is incapable of improvement, that on which it depends being given once for all as a physiological factor of one's organisation. To say that this general retentive power can be improved, is to say that our capacity for forming habits can be improved.

What is the use then of exercising the memory ? What is said above supplies the answer to this question. Memory exercises increase our stock of ideas, and so give a greater power of associating new knowledge with that already possessed. Thus, the musician easily learns a new piece of music, because, in truth, it is not all new to him. To take the simplest possible example—any piece of music is pretty sure to end with the *common chord* of the *tonic*, and the one who knows this knows what the last chord is before *perceiving* it. He knows it through association with what he has previously known.

What the teacher should aim at in the memory training of his pupils is an improvement in their methods of learning. He should train them so to learn as to form the greatest possible number of bonds of association with facts already known. "Of two men," as Professor James says, "with the same outward experiences, and the same amount of mere native tenacity, the one who *thinks* over his experiences most, and weaves them into systematic relations with each other, *will be the one with the best memory*."

The question has been often discussed, whether or not we ever completely forget anything that we have once known; that is, whether or not a fact once known ever so completely disappears as to leave no possibility of its recall. It is undoubtedly true that facts once known, and apparently completely forgotten, may be, and often are, recalled under great mental excitement, as, for instance, in the delirium of fever. We may, however, for all practical purposes, regard much that we have known as completely forgotten. Many seem to think that such forgotten knowledge is of no use whatever. This is a mistake. The acquisition of such knowledge has involved a certain amount of mental training, and has formed one of the moulding influences of our life. We are at the present moment what we are, largely in virtue of forgotten knowledge.

Just as habits are most easily formed in early life, so memory, so far as retention is concerned, depending on the same physiological basis as habit, is at its best in early life.

Memory presupposes sensation and perception. An image cannot be recalled until after it has been present in the mind, and yet in a rudimentary form it is, as we have seen, in perception. This is another indication that the arrangement of the mental activities into the various faculties is an abstraction, and such arrangement does not correspond exactly with the state of the case. The teacher and student should remember then that the general retentiveness probably begins to deteriorate at the age of 15 or 16. A man can, however, recollect a fact or group of facts often better than can a boy or girl, because he has a greater store of other facts with which to associate the newly acquired ones. Thus a man of 30 who is a good linguist, will learn a fresh language more quickly than will a boy of 10, though his general retentiveness is not so good. One reason for this is because in the languages he has already learned, he finds so much that is of service in the language he is learning.

One other point should be noticed. Associations formed in youth while the brain is plastic are more permanent than those formed later, when the brain has lost its great plasticity. In old age, the recently acquired knowledge is first forgotten for this reason.

Résumé.

I. **Recollection.**

1. This depends on association of ideas.
2. A good recollection depends on forming many associates with each new fact.
3. To develop memory is therefore to contract the habit of forming associations, that is of *thinking over* our new acquisitions.
4. To learn so many facts in too short a time—to do this is *cramming*.
5. In hunting for a fact, many associations may lead us away from it.
6. Hence the need for the exercise of the *will* in recollection.

II. **The formation of bonds of association depends** on:

1. *Interest* either *pleasurable* or *painful*.
    - *a*. The interest is direct when what is being learned is interesting in itself. In teaching infants, direct interest must be roused.
    - *b*. The interest is indirect when it does not lie in the subject itself, but lies in some ulterior advantage to be gained from knowing the subject. For instance, a student may study a subject that is not interesting in itself because he hopes to benefit in some way from a knowledge of it.
2. *Repetition.*—Interest is but rarely great enough to effect a permanent fixation without repetition. The greater the interest the less the repetition needed.

III. **Improvement of memory.**

1. General retentive power incapable of improvement.
2. The recollection may be greatly improved by accustoming oneself in learning to form systematic bonds of association.

IV. **Forgetfulness.**

1. Possibly we never completely forget anything once known.
2. Practically we forget much.
3. Forgotten knowledge has its uses.

V. **Memory development.**

1. Memory is best while the brain is plastic, that is in youth. It begins to deteriorate at 15 or 16.
2. As knowledge increases so does the power of forming bonds of association. Hence the power to learn increases long after the general retentiveness begins to diminish.
3. Associations formed while the brain is plastic are most permanent.

CHAPTER XIV.

IMAGINATION.

To remember is not only to recall a mental state, but to recognise such mental state as having at some past time formed part of one's own mental life. To call up images in the mind without recognising them as having formed part of our past mental experience, is to **imagine.** The term **imagination** as ordinarily used denotes the process by which we recall past percepts and form them into totally new combinations, the like of which have never come within our experience. Such new combinations are sometimes spoken of as *creations* of the imagination. If to *create* means *to form out of nothing*, then man could no more *create* in the mental world than he can in the physical world. Whatever new complex images are formed by the imagination, they are always made of elements out of past experience. Imagination is a process of *construction*, and not of *creation*. Just as the builder who builds new houses with the materials of old ones, is said to build or construct, but not to create.

It is clear from the above definition of imagination, that without memory, there can be no imagination, for imagination is the re-combining of *recalled* percepts; and we have already seen that memory depends on sensation and perception. Hence imagination is a stage of mental activity higher than sensation, perception and memory, for it depends on all three.

If we classify the different forms of the imagination according to the materials with which it busies itself, we may arrange them under three headings,

1. Intellectual imagination.
2. Imagination in invention, and
3. Æsthetic imagination.

In *intellectual imagination* there are two stages. The lower stage enables us to form ideas of places, persons, or objects when described to us, though we have never seen them. This form of imagination enables us to acquire vastly more knowledge than would be possible without it. In teaching history or geography it is being continually called into play. A child hears his teacher describe some place and he straightway pictures it to himself. What is formed in the mind is nearly always a *visual* image. If a fruit which we have never seen be described to us we at once imagine what it *looks* like rather than what it *tastes* like. Imagination evidently is not, as the older educationists thought, a hindrance rather than a help in education. The second and higher stage is the process by which the imagination forms an image of something altogether new without receiving aid from others as it does in the lower stage.

Thus, when a riddle is asked, the imagination is very active in framing answers, each of which is in turn tested by the conditions of the question. The framing of an answer is the work of the imagination in the higher stage. Again, we hear of an explosion of gas (say) and we instantly begin to guess causes for it. In fact, when any unusual phenomenon comes under our notice, it is almost impossible to prevent ourselves from imagining reasons for such phenomenon, and it is a great relief when we find that we have found out the real cause. To many this kind of mental activity may seem a simple and unimportant affair. It is, however, this "intellectual curiosity," and consequent activity of the imagination, to which the advance of knowledge is greatly due. The laws of planetary motion discovered by Kepler, and their explanation, (the law of gravitation) discovered by Newton, are magnificent examples of results due to the exercise of a high power of imagination.

Nearly all inventions are due to the exercise of the imagination. The infant early shows a power of invention. Watch a child playing with a box of bricks, and see what new forms of structure he tries, or watch him cutting out shapes with scissors, and see how he will exercise his imagination in devising new shapes to cut out. "One of the most striking instincts of a child is construction; at first simply imitative, and then imaginative and original." The invention of any new mechanical contrivance, depends upon imagining what will be the action of a new combination of the simple mechanical powers. Of course the difficulty lies in *imagining* what will be the combination most likely to accomplish the purpose in view. In all such applications the imagination is subserving practical purposes.

The third form of imaginative activity is the exercise of the imagination in satisfying our æsthetic feelings, or sense of the beautiful. It is this form of the imagination which has produced all the fine arts. Thus the subject of poetry is generally the work of the imagination. The scenes that Milton describes in *Paradise Lost* are the products of his imagination. For even the elements of these scenes he had to rely upon memory, as he was blind when he composed this poem. So too, the musician imagines new combinations of elements in sound or new successions of elements or of their combinations such as to satisfy our taste for the beautiful in music. It is a wonderful fact that Beethoven was quite deaf when he composed all his finest music, so that he had to rely upon his memory for even the elements of sound. The artist, again, in painting a picture has to draw on his imagination. Of course the elements that go to make up such a picture are at the time, or have previously been supplied, to the artist by his senses; but the greatness of the product as a work of art depends upon the way in which those elements are combined. If they are so combined as to satisfy our sense of the beautiful in form and colour, we look upon such a picture as a work of art.

What is said above suggests that different people are gifted with different forms of imagination. One has an imagination for the devising of new forms, another for new combinations of colour, another for devising new successions of sounds (such having the gift of melody), another for diving into the causes of natural phenomena. Of course this variation of imaginative power in different people is partly due to special training, but the differences are largely due to causes beyond our own control. It is quite evident that the vast majority of mankind, whatever might be their training, would never acquire the imaginative power of a Newton, a Beethoven, a Turner, a Milton, or a Shakespeare.

It has often been pointed out by psychologists, that the cultivation of the imagination is fraught with great danger. As we have seen before, since the mind is of finite capacity, the undue cultivation of any one faculty must be at the expense of others. It is further true, that by undue indulgence in flights of the imagination, it is possible to build too many castles in the air, and to neglect, or even scorn, the real "castles" of the world—to live in the ideal and too far forget the real—the danger, however, is not so much in the cultivation of the imagination, as in the neglect of the *will*. So long as our imaginative faculty is under our control, there is no danger to be feared.

Children often seem to have a wonderful power of imagination, but this is mainly because in children it is unrestrained by a knowledge of what is and what is not possible. A child will imagine himself a star because he does not know the impossibility of being such ; the adult regards such flights of fancy as *childish* because of his superior knowledge. In later life we cease altogether to build castles in the air, or at least we restrain such imaginative activity, for our reason calls us back to the commonplace and refuses to let us be led away by such vain visions. The imagination then is restrained by the acquisition of knowledge.

This is not, however, the whole relation between imagination and knowledge. Without knowledge, imagination is as impossible as it is for a builder to build without material. It does not, however, follow that he who has most knowledge has greatest power of imagination, any more than it follows that he who has most building material is the best builder.

The teacher has ample means in school work for training the imagination. Foremost among these for young children are *nursery rhymes* and *fairy tales*. Tell a child of three the tale of *The Three Bears*, and note the earnestness of his attention. This will reveal the fact that he is in a way imagining each successive scene. His power to do this is of course vastly increased by the aid of good illustrations, provided these are suitable and not too numerous. The way in which children resent too much explanation is well illustrated in the following anecdote from professor Sully's "Studies of Childhood." "A mother, when reading a poem to her boy of six, ventured to remark, 'I'm afraid you can't understand it, dear;' for which she got duly snubbed by her little master in this fashion: 'Oh! yes, I can very well, if only you would not explain.' The explaining," Professor Sully continues, "is resented because it interrupts the child's own spontaneous image-building, wherein lies the charm, because it rudely breaks the spell of the illusion, calling off the attention from the vision he sees in the word-crystal, which is all he cares about, to the cold, lifeless crystal itself. . . . ."

Any illustrations or additional details should aim at making the picture of the child's own spontaneous imagination more vivid and real.

In nursery rhymes much of the attraction depends on the rhythm and the rhyme, but in such a story as that of *Jack the Giant Killer*, the interest must be in the tale itself, and the only way to get interest out of it is to picture to oneself the successive events of the story. History, if properly taught, is regarded by young children much in the light of fairy tales, and, along with geography, it affords ample material on which to exercise the imagination.

All *illustrations* are essentially a help to the imagination.

Models are the best illustrations possible for children where the object is not so much to cultivate the imagination as to impart accurate ideas. Accurate models leave to the imagination only the question of size and perhaps colour. Size is easily imagined. When we look at a carte-de-visite of a friend, its small size does not strike us as curious. By an act of imagination we make a correction for size. The readiness with which we imagine *size* is probably due to the fact that we are constantly seeing familiar objects at ever varying distances, thus having retinal images of the same object ever varying in magnitude.

Pictorial illustrations leave more for the imagination to do, because to gain an accurate idea of an object from a picture, one has to imagine not only size, but solidity. The essential point about *verbal* illustration is, that by making use of ideas already possessed, they are intended to give an idea of something which has not come within the child's experience. Thus a teacher wants to give a child an accurate idea of a tiger. Assuming that the child has an idea of a cat and of a mastiff, he tells him to think of an animal like a cat but as large as a mastiff. The child at once combines two known ideas to form a new one, thus under the guidance of the teacher, gaining a fairly accurate idea of an animal which he has never seen. Every illustration must in some way resemble what is being illustrated, otherwise it is no illustration at all. Verbal illustrations must be drawn from familiar objects, as the essence of illustration lies in the making clear what is unknown by the light of what is known.

All school subjects in which the children are required to form images of objects that have not come within their experience, are means of training the imagination.

In a reading lesson, for instance, the child by the help of the teacher is constantly gaining new ideas, nearly all of which are the result of an exercise of the imagination.

For older scholars, composition exercises afford ample opportunities for calling the imaginative faculty into play.

Résumé.

I. **Imagination.**

1. Definition.—Imagination is the mental process by which we recall past percepts and form them into new combinations.
2. The imagination does not *create* but *constructs*.
3. Imagination involves the recall of percepts, and is therefore dependant on memory which depends on perception, and that on sensation.

II. Forms of Imagination.

1. Intellectual imagination.
   - *a.* In its lower stage forms ideas of unknown objects by the help of other persons, *e.g.*, forming an idea of a place from a description of it. This is valuable in education.
   - *b.* In its higher stage it recalls percepts, and recombines them into new forms without extraneous help. This is often carried out under the influence of *intellectual curiosity*. To this nearly all progress of knowledge is due.
2. Imagination in mechanical invention.—Inventions depend on the imagining how new combinations of the simple machines will act.
3. Æsthetic imagination.
   - *a.* This has given us the fine arts. The poet, musician and artist, must have this form of imagination highly developed.

III. The differences of imaginative power are due:

1. Partly to special training.
2. But largely to natural causes over which the individual has no control—that is, the differences are largely innate.

VI. Imagination and knowledge.

1. Knowledge limits and restrains the freedom of the imagination, but
2. Knowledge supplies the imaginative faculty with materials to work upon, and is essential to its least activity.
3. The imaginative power of children seems great, but its apparent greatness is only due to a lack of knowledge to distinguish between the possible and the impossible.

V. Dangers of the imagination.

1. Over cultivation of the imagination means neglect of other faculties.

2. It is said to tend to make one live in the ideal and forget the real.
3. There is no danger so long as it is kept under control of the will.

VI. **Means of training the imagination.**

1. Nursery rhymes and fairy tales.
2. History and geography.
3. *Illustrations :*
   - (*a*) *Models.* Size and colour only to be imagined.
   - (*b*) *Pictorial.* Solidity in addition to be imagined.
   - (*c*) *Verbal.* These give help in combining old ideas to form definite new ones.
     - (1) They must be like what they are intended to illustrate; and
     - (2) They must be familiar.
4. All school subjects which require the formation of images of objects not previously known.
5. Composition.

CHAPTER XV.

CONCEPTION.

We have already seen that many impressions of the *same* object made on the senses at different times result in a *percept*. A similar process of elaboration of *like percepts* may go on resulting in a *concept*, which bears much the same relation to the percept as this latter bears to the individual impressions from which it results.

A concept is a complex idea elaborated out of many percepts; it is a general notion or idea of a class, *e.g.*, the idea of *book*, not of any particular one, but of *book* in general. That we have such an idea is evident from the fact that we can recognise a book when we see it. This recognition would be impossible unless we had some idea with which the sensuous percept of any object recognised as a book at least in part agrees. As the process of forming *percepts* is *perception* so the process of forming *concepts* is *conception*. The student should carefully note that *conception* is a mental process resulting in a concept. The exact nature of the concept has ever been and still is a matter of dispute. But whatever its nature may be it is something very different from a percept. When I perceive a particular soldier I have in my mind an image definite, vivid and clear; but when I conceive or form an idea of soldier in general, if there is any image at all formed it is vague, faint and blurred, or possibly a series of images of particular objects contained in the class pass through the mind. The best illustration that can be given (though even that may convey a wrong idea) is the composite photograph.

The photographer can now take the photograph of one member of a class, then of another, and then of another, and so on, till the whole class be taken on the same plate, each successive photograph being superimposed on, and modifying all the preceding ones. The final result is an image of no one in particular, but of the whole class in general. It conveys a general idea of the class. The concept is much like this composite photograph.

Suppose I want to form the concept expressed by the term *crystal*. I take a number of different crystals, carefully examine the first so as to accurately "photograph" its image on my mind; I do the same with the second, and successively with all the examples of crystals present. Finally each individual image (percept) becomes vague, indistinct and blurred, being modified by all the others, and the final result is a blurred mental image of the lot, representing the idea I have gained of crystal in general. Many modern psychologists think that a general idea has no corresponding *image* at all. Psychologists generally analyse conception into the three elementary processes of *comparison*, *abstraction*, and *generalisation*.

When we wish to systematically form a concept of a class of objects, we in the *first* place get together a number of typical examples of such class which we proceed to *compare* in order to discover their common attributes. The more examples we compare together, and the more typical such examples are, the more accurate will be the resulting concept. The specimens must each bear some resemblance to all the rest, that is, they must possess certain common attributes, or otherwise they do not form a class and therefore no concept is possible.

The *next* step in the process is the withdrawing of the attention from those qualities which are peculiar to the individual objects, or common only to a few, and fixing it on those attributes that are common to all. This is called *abstraction*, because the mind is abstracted from certain attributes and fixed on others.

Finally, in attending to the common properties we naturally proceed to regard all the objects possessing these common properties as forming a class, and this is all that is meant by *generalisation*. In gaining new concepts these processes are not always consciously gone through. In many, perhaps in most cases, the concept is formed by the process of discovering the meaning of the class name.

Children generally gain their concepts in this way. The child sees an object which he hears called a dog. He notices some of the more striking features of this dog, probably that he moves and has four legs. Soon after he sees a fox which also possesses the same features, and he at once calls it a *dog*. Possibly the differences between the *fox* and the *dog* are pointed out, and the child's concept of *dog* becomes more accurate. On the other hand he may see a dog so different from any he has seen before that he will call it something other than a *dog*. Again he is corrected, and probably at the same time he has pointed out to him some of the special attributes in virtue of which such animal is called a *dog*. His concept of *dog* is thus widened and made more accurate, so the process of correction goes on (or should do so) until his concept is such that it includes all kinds of dogs and nothing else. His concept is then, and not till then, accurate. This accurate concept whatever its nature may be, evidently involves all the attributes an object must possess in order rightly to be called a *dog*. These attributes are what the Logician calls the *connotation* of the term *dog* (for fuller explanation of this term, see Cusack's Reasoning Processes, Chapter VI.). To give the connotation of a term is to *define* it. The best way of testing the accuracy of our concepts is to try to define them. A great part of education consists in enlarging the number of concepts or in correcting those already possessed. To possess all the concepts relating to any branch of knowledge in an accurate form is to have on such subject the most perfect knowledge possible at the present time.

Many of our concepts are often hazy, that is, we use class names, and we do not know exactly what things belong to such class and what do not. This is due to a lack of knowledge as to what are the common properties of the class, the idea of which is the concept. The haziness of a concept may proceed from inaccuracy or indefiniteness of the individual percepts out of which it is constructed. This haziness in concept is productive of all sorts of verbal disputes, and fallacies in reasoning. Many concepts are not merely vague, they are positively *inaccurate.* Sometimes they are too wide. This is the case when some one or more of the essential common properties are omitted. Thus, if I form my concept *fish* on the common property of the class that they live in the water, my concept is too wide, for the class of which it is the idea is too large, including such things as whales, porpoises, etc., which are not fish though they live in the water. Frequently, too, our concepts are too narrow. This proceeds from regarding as essential-common-properties, properties which are unessential, or which are not common to all the class. Such inaccuracy generally arises from the comparison of too few examples of the class. Thus, a child sees half-a-dozen watches all of which are wound up with a key, and he naturally concludes that it is an essential property of all watches that they are wound up by means of a key, in which case his concept is of course too narrow as it does not contain keyless watches. Teachers can do much to prevent inaccuracy in the concepts of their pupils by getting them to examine and compare many typical examples of the corresponding classes of objects.

Conception is a higher stage of mental activity than any of those already considered. It is the first that explicitly deals with *general* knowledge, or with knowledge of classes of objects. Hence the teacher must not expect to find it highly developed in young children, although the power of forming concepts *begins* to manifest itself very early. As soon as the child can see similarity amidst dissimilarity he begins to form concepts. At first these concepts are ideas of small classes. Doll, cradle, gee-gee, bow-wow, pudding, clock, etc., soon become represented by concepts in the child's mind. These early concepts are of course inaccurate ; more frequently too wide than too narrow. As the number of concepts in the child's mind increases, those already formed become more accurate ; the two processes, the acquisition of fresh, and the correction of old, concepts, go on together. Further, the child not only increases his stock of concepts, but concepts of a more or less general or abstract kind are formed. Such difficult concepts as those denoted by *vicious*, *virtuous*, *honourable*, *patriotic*, etc., are quite beyond the conceptual power of children. Although children delight in the concrete, yet they are often quick in seeing likenesses which are to the adult anything but striking. Thus children, when learning the alphabet, constantly notice the forms of the letters in all sorts of odd places, as, for instance, in the pieces of bread and butter they eat. This represents an early stage of abstraction on which the formation of concepts mainly depends.

In training this faculty, the teacher should remember that the points of resemblance among the individuals of a class may be much emphasised by contrasting several members of the class with an object belonging to another class altogether. Thus, in trying to give children the idea of a *metal*, several different metals should be compared together and their most striking common properties pointed out; when this has been done, then each metal examined should be contrasted with some such substance as sulphur. By showing that they all differ from sulphur in a similar way, the attention is more strikingly drawn to their common properties. When the *idea* has been gained, then the corresponding *term* should be given. The saying "Things not Words" is somewhat shallow, "Things and Words" is psychologically more correct. When the essential properties of a class are associated with a class name, the concept itself is made more definite and becomes thereby much more likely to be retained. In teaching, the idea should, whenever possible, be given first, but the *name* should be given as soon as ever the idea has been conveyed.

Different persons differ greatly in conceptual power. Some seem never to gain any power of forming general notions. A *class* name suggests to their mind a particular member of the class. Such persons seem to see differences so readily as to hinder their seeing similarities. The differences in conceptual power are largely due to differences in training, but not altogether—much of the difference is due to what is innate. It is often said, "We are all born equal;" nothing can be falser. If that were true, then any child with proper training could be made to become a Newton.

Résumé.

I. **Concept.**

1. The concept is elaborated out of a number of like percepts.

2. Our concept of *book* enables us to recognise a book as such when we see it.
3. It is a general notion or idea of a class.
4. Conception is the mental process by which concepts are formed.
5. The nature of the concept is doubtful. If there is an image it is faint, vague, blurred.
6. Composite photograph is the best illustration.

II. **Conception.** In this there are three steps.

1. *Comparison* of different members of the class.
2. *Abstraction*, or withdrawing of the attention from differences and fixing it on similarities among the objects compared.
3. *Generalisation*, or the regarding all the objects possessing certain common properties as forming one class.

III. **Connotation** is the logical term applied to the meaning of a term which implies the essential common properties of a class.

To define is to state the connotation of a term.

IV. **Imperfection of Concepts.**

1. *Haziness.*
   - *a*. A lack of exact knowledge as to what are the common properties.
   - *b*. Inaccuracy or indefiniteness of the component percepts.
2. *Positive inaccuracy.*
   - *a*. Too wide; when objects are embraced in the idea which does not rightly belong to it.
   - *b*. Too narrow; when objects are excluded which should rightly be included.

V. **Conception depends on retention of percepts.**

1. Therefore it is a high stage of mental activity not fully developed in children.
2. Still it *begins* to manifest itself early in life.

VI. **Training Conceptional Power.**

1. Simple concepts depending on few common qualities to be first given, *e.g.* the concept, *white objects.*
2. To emphasise the common attributes, contrast with objects not possessing them.
3. Give the name immediately after having given the idea—"*Things and Words.*"

CHAPTER XVI.

JUDGING.

In common speech *to judge* is to come to a decision; the man who *decides* what punishment shall be meted out to a prisoner we speak of as the *judge*, while those who first *decide* whether the prisoner be guilty or not we call the *jury*, although, in reality, they *judge* as much as does "the judge."

In psychology *to judge* has a wider meaning. By perception we form percepts (simple ideas); by conception, we form concepts (general ideas), and by *judging* we see relations between our ideas. To *judge* is to perceive relations among the products of lower stages of mental activity. Thus I have a concept corresponding to the name *fern*, and another corresponding to the word *plant*. Moreover, I perceive a certain relation (the inclusion of one in the other) between the two concepts, that is, I *judge*; the result of my judging is a *judgment* which is expressed in the words—*ferns are plants*. Note that *judging* is the process and a *judgment* is the result. The term *judgment* is, however, often used to denote the *faculty* by which we perform an act of judging. In adult life we seldom or never judge without putting the judgment into a form of words. The verbal expression of a judgment is in logic called a *proposition*. (See Cusack's Reasoning Processes. Ch. VII.) The study of the meaning of propositions and the relations between them is logic; such study is, however, beyond the scope of the psychologist.

It will be seen that judging, or the perceiving of relations between previously acquired ideas, is not a process absolutely different in nature from those already considered. The same process in an elementary form is involved in every act of *perception*, for to perceive one must recognise relations between a present impression and the ideas of previous ones. So, too, judgments are involved in every concept. The student may again be cautioned against regarding the intellectual faculties as entirely separate entities; they are separable only by abstraction, and are regarded as separate only for convenience of instruction. The various judgments formed by any one may be arranged in three classes, the classification depending on the difficulty of making the judgment in the different cases.

The decision that arises in the mind instantly, as it is needed, is called the **intuitive judgment**. In such cases the judgment costs no effort at the time. That honesty is right and should be practised, that falsehood is wrong and should not be practised, that whatever work we are paid for doing should be done to the best of our ability, that two and two are four, etc., are all *intuitive judgments* for the adult, though not for the child. Whether a judgment is intuitive or not depends mainly upon the number of times such judgment has been formed. The judgments involved in perceptive acts are, as a rule, of the intuitive kind. Thus I see an object before me which presents to me the appearance of my inkstand, which I instantly judge such object to be. But it is possible that such judgment is a false one, and that it it is not in reality my inkstand. In many cases an object can be recognised only as a result of careful examination. In such cases the judgment involved ceases to be intuitive. Our intuitive judgments are not always reliable—a truth which is illustrated by the saying, "Second thoughts are best."

The *second* class of judgments consists of those which result from comparison and choice. The child when learning grammar gradually gains the concept expressed by the word *verb*. He is then exercised in picking out verbs. He compares the meaning (as it appears to him) of a particular word with his concept of a *verb*, and then judges that such word is or is not a verb. This requires a much greater effort of mind than is needed for an intuitive judgment.

Finally, many of our judgments are the results of long trains of reasoning. Thus the judgment of "guilty or not guilty" given by a jury is the result cf a careful weighing of all the evidence (often most conflicting.) The success or failure of the man of business depends mainly upon the degree of accuracy he reaches in these more complex judgments.

Clear lines of division cannot be drawn between these classes of judgments. Nature seldom draws hard and fast lines. When they are drawn it is, as a rule, for the convenience of study rather than because they are in accordance with nature. Our judgments may be faulty for different reasons. In every judgment there are at least two ideas (since to judge is to see a relation between different ideas) either or both of which may be inaccurate. It is clear that if the ideas involved in a judgment are faulty, the judgment itself is not trustworthy. The judgment of one who declares a certain measure to be unconstitutional would have but little weight with others if it were known that his ideas of "measure" and "unconstitutional" were vague and inaccurate. Children's judgments are often faulty in this way. They hear their elders use words and sentences which they catch up, and afterwards make use of with an appearance of knowledge they are far from possessing—many parents without troubling to find out if such utterances are anything but parrot-like repetitions of what has been heard, take them as evidence of the unusual ability of the children. The old methods of education encouraged this by insisting on so much rote-learning, and taking it for granted that what was learned by heart was really known. This was the mistake Montaigne, the French essayist, was combating when in A.D. 1580, he wrote "*Sçavoir par coeur n'est sçavoir*" (To know by heart is not to know).

Even with accurate ideas our judgment may be false, in which case the fault is in the process of judging. This arises from various causes, one of which is *over-hastiness*. If I find a plant, and after a cursory glance judge it to be a buttercup, it may easily happen that I have not noticed some of its most characteristic features, which, had I seen, would have caused me to form a correct judgment and assign it to quite a different genus. There is in us what has been called "the bias of impatient impulse" which leads us to come to almost any conclusion rather than suspend our judgment.

Another frequent cause of faulty judgment is too great readiness to take for granted the truth of judgments formed by others, especially when such judgments are put forward with an appearance of authority. The commonest cause of false judgment is, however, the bias of feelings. We frequently hold a proposition to be true or false according to our desires. "The wish is father to the thought," too often. This influence of the feelings on the judgment is indirect. It is exerted mainly by inducing us to pay greater attention to whatever evidence favours the decision desired, and by withdrawing attention from everything that is repugnant to such decision. But whatever its manner of action may be, of its vast influence there can be no question. Anyone who will, can see instances of it daily. Every opinion of an opponent, an enemy, or a rival is utterly wrong. A politician makes a speech, and the next morning it is reported and criticised by different papers; by those which support the party to which the speaker belongs it is brilliant, admirably suited to the circumstances, its sentiments are excellent, etc., etc.; by those whose support is given to the opposite party it is dull, execrable in taste, its sentiments are grovelling, etc., etc. It is this bias of feelings that makes it so difficult to duly recognise merit in an opponent. It is the prerogative of man to control the feelings in accordance with the dictates of reason. Although in no one is such control perfect.

A judgment that is perfect must at least be *clear*, *accurate*, *prompt* and *stable*.

Our judgments are *clear* when we understand exactly what they imply. For this we must have a complete and clear knowledge of the ideas which our judgments involve. The study of logic is of great service in giving clearness to our ideas and judgments.

A judgment is *accurate* when it is in exact accordance with fact. If the moon be judged to be about the size of a Dutch cheese, the judgment is inaccurate as it is not in accordance with fact. Our inaccurate judgments frequently arise from over hasty generalisation.

It is often of great importance to be able to judge *promptly*, or "make up one's mind" quickly. This is just what people frequently fail to do. In cases of emergency they lose utterly the power of making a rapid judgment, and at once try to accomplish what their *feelings* suggest and that too in a way that is utterly irrational. In such cases, where there are many people gathered together, the consequence is panic and disaster. Promptness in judging if carried to excess becomes the fault of over-hastiness. In this, as in everything else, it is the *mean* that is *golden.*

Lastly, it is an excellence of judgments that they should be *stable.* We ought to have sufficient confidence in our decisions not to readily give them up or change them. One who is always changing his opinion at the slightest suggestion from another is not likely to accomplish much good in the world. He is like Reuben on whom Jacob uttered the curse, "unstable as water, thou shall not excel." One may, however, have too great stability of judgment, in which case he is said to be *stubborn.*

In trying to train the judging power of children, the teacher should remember that rightly directed exercise is all that is needed.

The judging faculty may be exercised in almost every school lesson. In writing and drawing the child has to judge of the likeness of his own work to the copy; in arithmetic he should be exercised in judging what the answer will approximately be; in geography he may be made to judge of distances by the help of the scale; in history moral judgments are formed; in making out the meaning of an author in a foreign language the pupil is continually judging, and so on. Of course in all these cases the teacher must carefully guard against suggesting the conclusion to be reached. The judgment must result from the child's own mental activity, and then if faulty its faultiness should be revealed by a series of Socratic Questions. Judgments formed by the pupils when under the influence of keen feeling should be discussed when such influence has passed off. Thus they may be brought to see the danger there is of forming judgments warped by feeling and altogether untrustworthy.

It should be noticed that much of the training of this faculty is carried on in the playground. Such games as cricket, football and "fives" demand the continuous exercise of the judgment. Cricket especially excels in this respect; in bowling, batting, or fielding, fresh difficulties are ever arising which can be successfully overcome only by the exercise of the judgment.

Résumé.

I. **Judging.**
  1. To judge means ordinarily to come to a decision.
  2. In psychology to judge is the process of discovering relations between ideas.
  3. The act of *judging* results in a *judgment*, and the expression of a judgment is a proposition.
  4. Judging is involved in perception, and in a higher form in conception.
  5. Judging is not a mental process absolutely different from other mental processes.

II. **Classes of judgments.**
  1. Intuitive when the judgment is formed without effort, immediately when needed.
  2. Judgments which result from comparison and choice, *e.g.*, the assigning of an object to a class as a result of a careful examination thereof.
  3. Reasoned judgments, or those which form the conclusion of a process of reasoning.

III. **Faulty judgments.**—Our judgments may be faulty from several causes.
  1. Lack of clearness and adequate knowledge of the component ideas—this is a characteristic fault of children's judgments.
  2. A judgment may be faulty from over-hastiness in forming it ; or
  3. From too great readiness to take for granted the truth of the assertions of other people, especially when they are put forth with an appearance of authority; or
  4. From the bias of feeling. This acts indirectly but is of vast influence.

IV. **Excellences of a judgment.**
  1. Clearness, or a full understanding of what it implies.
  2. Accuracy, or exact accordance with fact.
  3. Promptness, or rapidity in judging. Over-promptness of judgment becomes the fault of over-hastiness.
  4. Stability, or degree of permanence. *Too great* stability is indicative of stubbornness.

V. **Training the judging faculty.**
  1. Remember that rightly directed exercise is training.
  2. The judgment is exercised in nearly all subjects of instruction.
  3. And is greatly exercised in the playground.

CHAPTER XVII.

REASONING.

To judge is, as we have seen, to see relations between ideas, the result of the process being a judgment. These judgments supply the raw material for the reason, or the faculty of reasoning, to work on.

Reasoning or **inference** is the proceeding from one or more judgments to others based on them; it is perceiving relations among judgments in much the same way as judging is seeing relations among concepts. Thus given the two judgments—all metals are elements, and iron is a metal—any rational being can at once proceed to the further judgment expressed in the statement, iron is an element. No irrational being can do this; the being who bases the truth of the third statement on the truth of the first two proves himself by the very act to be endowed with reason. By reasoning we make explicit what is implicit in a judgment or judgments. Reasoning is the highest activity of the intellect, to which all the other intellectual activities minister. It is that which more than anything else marks off man from the rest of the animal kingdom. The definition of man as a *rational animal* is more than two thousand years old.

The new judgment to which we reason is called the *inference* or *conclusion*, and those from which we reason are called *data* or *premisses*. These *data* are derived ultimately from sensuous perception; there is, as we have already seen, no possibility of gaining any knowledge except in the first place by the use of the senses. The knowledge so supplied is of a comparatively simple kind; to elaborate it into complex forms and to greatly extend it is the work of the reasoning faculty. Further, the knowledge given us by perception is often very untrustworthy. Many people are subject to delusions, and still more to illusions of various kinds. Percepts depend greatly on the subjective state of the percipient. One effect of a good education is the conviction that the senses are unreliable, incredible as such a statement may seem to the uneducated.

Reasoning may be *implicit* or *explicit*. It is said to be implicit when we infer a conclusion without definitely setting before ourselves the premisses from which such conclusion is inferred. Thus a child picks up a red-hot cinder and is burned; on seeing another hot cinder he instantly passes to the idea of its power to burn. To make his reasoning explicit he would in thought have to go through some such process as this: A certain red-hot cinder burned me, therefore all red-hot cinders will burn me; but this is a red-hot cinder, therefore this will burn me.

The earliest instances of reasoning in the child are of the implicit kind, and even in adult life we constantly reason in this way. It is this implicit reasoning that uuderlies what we call *common sense*, the conclusions of which may be regarded as intuitive judgments. Such conclusions are often sound enough, though it would puzzle us to give an explicit statement of the grounds on which they are based. It was sound advice which was given by Lord Mansfield to a new Colonial judge: "Give your decisions boldly, for they will probably be right, but do not give reasons for them, for if you do they will probably be wrong."

Implicit reasoning is *unconscious reasoning*, and its conclusions are quite unreliable, except in matters of which one has had great experience.

Three forms of reasoning are generally distinguished, depending on the relation between the conclusion and the premisses.

Reasoning is said to be *immediate* when a conclusion is drawn from one judgment, or when, because of a known relation between two ideas we infer that another relation must hold between the same or between two closely connected ideas. Thus, from the one premiss—all books are useful—I may infer *immediately* that some useful things are books.

A far more important kind of reasoning is what is known as *inductive*. Reasoning is said to be *inductive* when the conclusion is more general (*i.e.*, is a wider truth) than the premisses on which it is based. Thus if I test twelve children out of a class of thirty, and find that each one of the twelve knows his work well, and from this draw the conclusion that all the class know their work well, I reason inductively. The premisses are :—

A knows his work well.
B " " " "
C " " " "

and so on for all the twelve tested, and the conclusion is, all the class know their work well. Clearly the conclusion embraces all the class, while the premisses embrace but a part of it ; and hence, the conclusion being more general than the premisses, the inference is an induction.

The third kind of reasoning is called *deductive reasoning*. Reasoning is *deductive* when one of the premisses is more general than the conclusion. One premiss is a statement applying to a class, and the conclusion is a statement referring to a part (often to one individual) of that class. Thus from the premisses—all mad dogs are dangerous ; this is a mad dog, I can deductively infer that This dog is dangerous. The conclusion here refers to one particular dog, while the premiss standing first refers to the whole of the class of mad dogs. The word deduction means literally a *leading down from*. In a deductive argument the particular truth (the conclusion) is led down from or brought out of the general truth (one of the premisses). *Induction* means a *leading or bringing in*. In an inductive argument we bring in particular examples to establish the truth of the general rule.

In all the three classes of reasoning, psychologically the process is much the same, and consists in basing the truth of one judgment on another (immediate reasoning), or on two others (deductive reasoning), or on an indefinite number of others (inductive reasoning).

Reasoning, like any other mental process, may be badly carried out. When this is the case the conclusion may be false even though the *data* are true. Such reasoning is said to be *invalid or fallacious.* Reasoning is *valid* when, granted the truth of the premisses, the conclusion is necessarily true. Valid reasoning is the subject matter of Logic, and is greatly promoted by its study.

Résumé.

I. **Relations between reason and judgment.**

1. To *judge* is to perceive relations between ideas.
2. To *reason* is to perceive such a relation between judgments that, granted the truth of one or more, another is necessarily true.
3. Hence, reason bears to judgment a similar relation to that which judgment bears to conception.
4. Reason is a stage higher than judgment, forming the crown of the intellect.
5. The judgments reasoned from are the *data* or *premisses.*
6. The new judgment reasoned to is the *inference* or conclusion.

II. **Reasoning is—**

1. *Implicit*, when the grounds of the conclusion are not clearly set forth, or
2. *Explicit*, when the mind clearly recognises the grounds of the conclusion.

III. **Kinds of Reasoning.**

1. *Immediate*, when the inference is made from a single premiss.
2. *Inductive*, when the inference is made from an indefinite number of premisses, but is more general than the premisses.
3. *Deductive*, when the inference is made from two premisses and is less general than the premisses.

IV. **Reasoning is—**

1. *In-valid*, when with true premisses there is a possibility of a false conclusion.
2. *Valid*, when granted the truth of the premisses, the conclusion is of necessity true.

CHAPTER XVIII.

INDUCTIVE REASONING.

Inductive reasoning is of vast importance as by it are supplied the *data* for deduction. One of the two premisses of a deductive argument is a general truth under which a particular case is by the other premiss asserted to belong. The truth of this general premiss (in logic it is called the *major premiss:* see Cusack's Reasoning Processes, Ch. XIV.) can be known only by induction. Thus, it is a deductive argument to reason:—

All stones tend to fall to the earth. This flint is a stone.
Therefore this flint tends to fall to the earth.

Clearly the truth of the conclusion depends on the truth of the first premiss. How can the truth of this be known? Not by experience alone, for no one has ever tested it for every stone in the world. It depends on the inductive argument that what is true of those cases that have come under experience is equally true of all similar cases. Hence without previous induction there could be no deduction.

The growth of human knowledge has proceeded in this order:—

1. The observation of particular cases.
2. The application of induction to form generalisations.
3. The application of deduction to these generalisations to bring out clearly all that is implied in them.

These represent not only successive stages in the growth of human knowledge in the race, but also in the individual. Hence the importance of teaching children by the inductive method. It is nature's method to begin with particulars, and lead up to general statements; teaching is inductive (whatever the subject may be) whenever it begins with examples or particular cases, and from an examination of them proceeds to the general statement.

As we saw in the last chapter, the conclusions we draw are not always valid. This applies to inductive conclusions quite as frequently as, perhaps more frequently than, to deductive conclusions. An inductive conclusion may be unreliable for much the same reason as those for which a judgment may be untrustworthy. Among the causes of invalid inductions, the following may be mentioned as the chief. In the first place there may be a lack of careful observation. This is especially the case when, under the influence of *feeling*, we see in things what we want to see, and not what is really there. This is really a case of faulty perception. The *data* from which we generalise is often in a great measure *subjective*, and we regard it as entirely *objective*. Every one is more or less subject to this cause of error. It is only by exercising control over the feelings and by training the intellect that we can at all free ourselves from it.

A second fruitful source of untrustworthy induction is too great haste in generalising. The uneducated and ill-educated mind delights in general statements, and is seldom prepared to take the trouble to make such generalisations trustworthy. It seems a curious fact, that the more easily such conclusions are reached, the more removed from error they are thought to be by those who make them. The extension of our knowledge carries with it the correction of much that we once regarded as undoubtedly true, and hence it happens, that as our knowledge increases it tends to destroy confidence in our generalisations. Mr. Bageshot writes in one of his essays:—"A grocer has a full creed as to foreign policy, a young lady a complete theory of the sacraments, as to which neither has any doubt. A girl in a country parsonage will be sure that Paris never can be taken, or that Bismarck is a wretch." This is a passage which well illustrates the confidence of ignorance. The uncultivated man, who on meeting two or three foreigners finds them hasty tempered; straightway with all confidence, draws the conclusion that all foreigners are alike in this respect.

So the child who has had several examples of simple sentences for grammatical analysis, in all of which the subject stands before the verb and the object after the verb, soon infers that the subject always precedes, and the the object comes after the verb, and on meeting a case where this order is inverted, he fails to correctly analyse it. Generalisations are not unfrequently made from a single instance, *e.g.*, when a child concludes that every nursery possesses a rocking horse, because his own does. This hastiness in generalising arises from various causes, among which may be mentioned the general dislike of a state of doubt. Doubt is wearying, and we would be freed from it. Hence, often, instead of prolonging a state of doubt till we can reach a conclusion based on good evidence we cut the matter short by arriving at a conclusion for which we have no sufficient foundation. "An attitude of philosophic doubt, of suspended judgment, is repugnant to the natural man. Belief is an independent joy to him." (Minto's Logic, p. 23.)

A *third* great cause of the unreliability of inductive conclusions is the influence of feeling on our reasoning power. This influence is exerted in two distinct ways. In the first case the mind that is absorbed by feeling, being of finite capacity, cannot at the same time successfully perform any intellectual operations. The whole capacity is occupied with feeling and there is no room for thought. It is an experience common to everybody that under great emotional excitement, whether pleasurable or painful, there is no power to think. The teacher often sees examples of this in his class. At the last school attendance previous to the summer holidays very little work is done, every one being excited at the near approach of the holiday. We shall see, however, that a certain amount of pleasurable feeling is essential as a stimulus to the most effective intellectual activity. The second way in which feeling has an evil influence on reason is, as we have already seen, by biassing the judgment. We arrive at conclusions because they are attractive to us, and not because we are driven to them by cogent evidence.

What may be done to avoid this unreliable induction is suggested by what is said above. We must avoid all haste in generalising, and we must learn to control our feelings.

In school work the great thing is to lead the pupils to carefully examine a large number of particular cases before attempting to give the rule or general statement. The inaccurate inductions which the pupils have made must be corrected by questioning and by further examination of particular cases.

Certain subjects taught in schools are specially adapted for training the power of reasoning inductively. It should, however, be noticed that whether or not a subject is a means of a training in induction depends more upon the way in which it is taught than upon the nature of the subject itself.

The natural sciences are generally regarded as supplying the best means of a training in induction. Yet they are not infrequently taught in such a way as to supply no inductive training whatever. Thus, the teacher of Botany who in teaching the classification of plants gives his pupils at the outset the general characteristics of a particular class of plants, and then exercises them in identifying specimens of the class, is turning what should be an inductive subject to a deductive one. On the other hand, Arithmetic, which is essentially deductive, may be made to supply a large amount of inductive exercise. The teacher who teaches a new rule by giving easy oral examples, and from an examination of them leads the class to make the rule, is so far turning a deductive into an inductive subject. Grammar is another subject in the teaching of which the inductive method may be largely employed All the definitions can and should be taught inductively. Thus, to give a first lesson on the Adjective, the teacher might show a number of flowers, put the names of about a dozen on the black-board, and let the class say something (*e.g.*, the colour) of each ; then add to the names on the black-board words denoting the qualities given by the class, *e.g.*, *yellow* daffodil, *blue* hyacinth, etc , underlining each. The next step should be to get the class to see that all these words stand for qualities ; they should then be told that each underlined word is an adjective, and then asked what an adjective is. All the definitions of grammar should be taught in some such way as is here indicated for the adjective. "Object Lessons" are an excellent means of training the inductive faculty.

Résumé.

I. **Importance of Induction.**
  1. It supplies the *data* for deduction.
  2. Important in teaching, for it is nature's method.

II. **Unreliability of Inductive conclusions** proceeds from several causes.
  1. Lack of careful observation resulting in false data.
  2. Too great eagerness to generalise.
    a. Specially characteristic of the uneducated and ill-educated.
    b. Generalisations made sometimes from a single instance.
    c. General dislike of a state of doubt.
  3. The influence of feeling.
    a. The mind absorbed by feeling cannot be intellectual.
    b. Feelings bias the judgment.

III. **To avoid untrustworthy inductions.**
  1. Thoroughly examine numerous examples before generalising.
  2. Learn to control feeling by intellect.

IV. **School subjects**, which are means of inductive training. This depends more on the teacher than on the nature of the subject. But these may be mentioned :—
  1. Grammar—all definitions.
  2. Arithmetic—although essentially deductive.
  3. Natural science—specially suited for inductive teaching.
  4. Object lessons.

CHAPTER XIX.

DEDUCTIVE REASONING.

We have seen that induction employs itself in the establishment of general statements. The great importance of these statements lies in extending our knowledge much beyond the point that could be reached by induction alone. This becomes clear if we consider any branch of mathematics. Take the case of Euclid's Geometry. Geometry is a typical deductive subject. It starts from a very few general principles (established by inductive inference from experience) which are used as premisses for long chains of deductive reasoning resulting in knowledge that would otherwise be quite beyond human reach. This is a truth most unlikely to have been discovered by induction applied to the *data* of experience. Again, it was by deductive reasoning that the late Professor Adams was enabled not only to infer the existence of a planet which no one previously had ever seen or thought of, but also to tell where at a particular time it might be seen if any astronomer would turn his telescope to look for it. So, too, without deduction we should know nothing of the real distance, magnitude, or nature of the heavenly bodies. Newton established his wonderful law of gravitation and such law is made by all subsequent astronomers an ultimate premiss of almost every astronomical calculation carried out by them. Frequently a deductive conclusion is such that it can be tested by an experiment. A celebrated instance of this is the case of Torricelli carrying a barometer up the Puy de Dome in the Auvergne Mountains. His master, Galileo, had said that the mercury in a barometer tube was supported by the pressure of the atmosphere, and Torricelli at once deductively concluded that if such was the case the mercury would gradually fall if the barometer should be carried up a hill. This he proceeded to test by carrying his barometer up the Puy de Dome.

Reason is complete only when induction is crowned by deduction. This relation between the two explains why, as any branch of knowledge becomes better known, it becomes more deductive and tends gradually to take its place as one of the "exact" sciences. In every day thought we constantly make use of deduction. Thus I see a fungus growing which I recognise as a mushroom; and which I gather *because* I know that all mushrooms are good to eat. The explicit statement of this act of reasoning is, all mushrooms are good to eat. This is a mushroom; therefore this is good to eat. This is a type of a deductive train of thought forming what logicians call a *syllogism*. For the method of testing the validity of such arguments the student must consult some text book of Logic. It will be seen by reference to the above example that the conclusion of a deductive argument is the judgment of a relation between two ideas (the ideas of "this" and of "things good to eat") inferred from two previous judgments, by which each of these ideas is compared with the same third idea ("mushrooms"). The relation between the ideas in the conclusion is not *immediately* inferred but *mediately* through a third idea. This third idea is called the *middle term** by logicians. It should be noticed that although according to the logical order the premiss consisting of the general statement stands first and the conclusion last, psychologically this is often not the case. In actual reasoning the conclusion is frequently presented to the mind first and the general statement is given as a reason for this. In school work deduction is constantly being called into play. Every satisfactory answer to the question "why?" involves deductive reasoning. To answer this (often difficult) question "why," the child has to give the general law under which some particular statement is made. Thus, "why does this stone tend to fall to the earth"? Because all stones do so. This answer is not merely saying that it does because it does. As far as it goes it is a correct answer. All explanation of individual phenomena consists in pointing out that such phenomena are not isolated but are merely instances of classes of similar phenomena.

---

* See Cusack's Reasoning Processes. Ch. XIV.

In school work frequently the general rule is given and the pupils are set to find examples of it, or to apply it to solve particular problems. Thus, in grammar having learned that a noun is a name (the definition of general statement) the pupils are required to give examples. So in arithmetic, when the rule has been once explained, they are expected to apply it to the working of particular examples. It should be noticed that deductive teaching is essentially dogmatic. The general statement is given and its truth taken for granted. So far as any attempt be made to prove the truth of the general statement, so far does the teaching become inductive.

Résumé.

I. **Principles established inductively become data for deductive reasoning.**
  1. Our knowledge becomes thus greatly extended.
  2. Deductive conclusions often capable of being tested.
  3. Deduction is the highest stage of reasoning.
  4. Therefore, all branches of science as they advance tend to become deductive.

II. **Deduction.**
  1. In constant use.
  2. A complete deductive thought is called in logic a *syllogism*, and consists of the inferring of a relation between two ideas, by comparing each with the same third idea.
  3. Deductive reasoning is therefore *mediate.*
  4. The order of the premisses is psychologically variable though logically fixed.

III. **Deduction in School Work.**
  1. It is involved in every real answer to the question "Why?"
  2. All explanations of individual phenomena consist in showing that phenomenon in question is like other phenomena.
  3. Often the general rule is given, and has to be applied to particular cases,
  4. Deductive teaching is essentially dogmatic.

CHAPTER XX.

FEELING.

We have already seen (Chapter IV.) that **feeling** is one of the three fundamental activities of mind, that is, that it is a form of mental activity that is incapable of being resolved into or defined in terms of intellect or will. Intellectual activity leads through feeling to volition. Any intellectual act is accompanied with a purely subjective state which the ego either wishes to prolong as being pleasant, or to bring to an end as being painful. It is this accompanying pleasant or painful subjective state that is properly called feeling. If the feeling is pleasurable we *will* to prolong it, and if painful we *will* to cut it short. This feeling bridges the chasm between intellect and volition. This is an important point and must be carefully noticed. Since feeling is not intellect it is clear that it cannot be defined; for to define is to express one *idea* by means of other simpler *ideas*, and feeling is not an *idea*. One who has never felt could not be made to understand what is meant by *feeling*.

The feelings may be classified on the grounds of different forms of intellectual activity in connection with which they rise. Thus there are:

1. Sensuous feelings.
2. Intellectual feelings.
3. Æsthetic feelings.
4. Moral feelings.

The **Sensuous feelings** are the pleasurable or painful states of consciousness which accompany immediately the exercise of the senses. What decides whether a sensuous feeling is one of pleasure or pain is frequently a difficult question. Generally speaking a sensation that allows the attention to be steadily focussed on it without involving too great an effort is pleasurable, and one that does not do this is painful.

It is important for the teacher to remember that the use (not abuse) of any faculty gives pleasure, and that its enforced disuse may be a cause of great pain.

The **Intellectual Feelings** are those that arise from the exercise of the higher intellectual faculties. "The more or less spontaneous workings of the imagination as well as that direct control of this working necessary to thinking in the stricter sense are always productive of pain or pleasure in the varying degrees."* Under this heading comes such feelings as feelings of *hope*, *expectation*, *fear*, *doubt*, *accuracy*, *consistency*, and (for the teacher) the highly important feelings of *wonder* and *curiosity*. Wonder arises in the mind on experiencing what is so strange as to be incapable of being at once connected with, and explained by, past experience. Thus, on first seeing an electric tram, the child wonders because nothing is seen to move it. This feeling of *wonder* often gives rise to a definite desire to be able to assimilate the new and strange experience to the old and familiar, and is then known as *curiosity*. It has been said that "philosophy begins and ends in wonder."

The teacher who can rouse in his pupils this feeling of wondering curiosity in sufficient intensity to make them ready to take trouble to satisfy it, possesses one of the most important secrets of the teacher's art.

The **Æsthetic Feelings** are those that arise along with the perception in external objects of what is generally called beauty. Thus the pleasure with which we look at a beautiful picture, and that with which we listen to a beautiful piece of music, are examples of æsthetic feelings.

The **Moral Feelings** are those pleasurable or painful mental states that arise from the contemplation of human actions as right and good, or wrong and bad, respectively, and which may all be included under the terms *love of virtue* or *hatred of vice*. Of course a purely moral feeling can involve no idea of gain or loss to oneself. To refrain from lying, for instance, simply from fear of punishment is

---

* Dr. Ward.

non-moral. The would-be thief who refrains from pocket-picking *because* the policeman's eye is on him is not therefore a moral man.

The relation between feeling and intellect is an intimate one. In the first place, as we have already seen, feeling always takes its rise in conjunction with some intellectual activity, and is, therefore, in a sense dependent on it. Further, feeling is a mental activity as truly as is intellect. When feeling is intense, the mind is absorbed by it and has, therefore, for the time being, little or no power of being intellectually active. The mind is of finite capacity and can no more be engaged in intellectual activity when "full of" feeling than a vessel full of water can at the same time be full of something else. It is a matter of common experience that when weighed down with grief one is incapable of reasoning. Feeling, then, is for this reason inimical to intellectual work. It also hinders the intellect in its work by biassing the mind in favour of certain definite conclusions. This has been already pointed out in the Chapter on Inductive Reasoning. There is, however, another side of the question. A pleasurable feeling reacts on the intellectual activity from which it springs, making the mind will to prolong such activity. No sustained intellectual activity would ever be carried out were it not that some feeling of interest forms the necessary spur. We cannot *attend* to what in no way *interests* us.

The teacher, then, who wants his pupils to do good intellectual work must do his utmost to rouse a steady feeling of interest in whatever is being done and, at the same time, must carefully guard against any over excitement of their feelings.

There is still another way in which feeling and intellect are related. Many feelings are in the main, consequences of the higher cultivation of the intellect. This is the case with the æsthetic feelings. Anything like a full appreciation of the beautiful, comes only as the result of long and arduous training which is almost, if not entirely, intellectual. Hence it is that many great works of art, such, for instance, as some of Turner's landscapes and Beethoven's Symphonies, remain and will long remain "*caviare to the general.*"

We have just seen that *feeling* results from *knowing* and results in *willing*. Feeling, when regarded as that which excites the will is called *interest*. This interest may be pleasurable or painful. We are as much *interested* in what is to us a misfortune, as in what is a piece of good fortune. We "can't help thinking of it," as we say, that is, our interest rouses our attention. Attention is never given without being called forth by some pleasurable or painful interest. The teacher who wishes to gain the attention of his class should always bear in mind, that this cannot be done without interesting them. It is much better that the interest should be a pleasurable, than that it should be a painful one.

The child may have a pleasurable interest in the work itself, such interest being called *direct* or *immediate*. It should, however, be always borne in mind by the teacher, that it is almost, or quite, impossible for a child to take interest in a subject which is suited only to a stage of mental development above that which he has reached. Thus, it is useless to expect young children to take any keen interest in subjects of a highly abstract nature, *e.g.*, grammar. Indeed, whenever the teacher fails to rouse interest in his pupils, it is, provided he be a good teacher, a strong reason for believing that the subject is unsuited to the class.

Pestalozzi was one of the first to emphasize the fact that children naturally take a keen interest in doing what their special stage of development fits them to do. The use of our faculties is a source of keen pleasure. Children especially delight in using their new powers. In a perfect system of education, all or nearly all, school work would be a real pleasure to children.

Young children have no power of looking far forward into the future for the interest in their work: their interests are interests of the present, direct interests. With developing powers, however, the child becomes more and more capable of building up a future, and of looking to that for the interest in what they do. He learns to work at what is in itself uninteresting in order to obtain a reward of some kind in the future. The interest then taken in the work is said to be indirect. In adult life most of our interests are of this indirect kind. Thus, the majority of people do their daily work, not because they like it, but because they have an indirect interest in it of a pecuniary kind. The rewards that give such indirect interests are of very various kinds. We may do something we do not like in order to gain the praise or approbation of those we love. To gain the praise of the teacher is a powerful "spring of action" with the ordinary school boy or girl. Or the motive of our work may arise from the expectation of gaining some more tangible reward, as when a student sets himself resolutely to prepare for an examination in the future because he knows that the passing of it will prove of a pecuniary value to him. Many indirect interests are what may be called painful interests. Our motive for acting is not always the gaining of some pleasurable result or reward, but often is the avoiding some unpleasant result or punishment. All such effective painful interests are of the indirect kind; for if an act were directly painful it would never be performed except under the influence of the hope of gaining in the future some pleasure which outweighs the influence of the present pain. Thus, it is impossible that a boy should do his lessons simply because he dislikes doing them; if he dislikes them and still does them it is because he hopes merely to avoid a feeling more unpleasant than his dislike of the lessons, or to gain some reward.

A judicious system of punishment may do much in supplying effective painful interests in cases where pleasurable interests are ineffectual. The only justifiable motive for punishment in the school is the establishment in the child's mind of such a bond of association between certain kinds of actions and certain unpleasant circumstances of so close a nature, that whenever the idea of any such action arises it shall invariably call forth an idea of inevitable unpleasant results, in the hope that the idea of the latter will prevent the idea of the former from being realised in act.

It should be remembered that punishment of any kind is pain, and therefore to be avoided as far as possible; and that it is exhausting and repressive of activity. The teacher who gets certain work done by punishment, or from fear of punishment, should remember that he is obtaining certain results in a very expensive way. Keen feeling, whether of a pleasurable or painful kind, is, as we have already seen, fatal to good intellectual work.

A certain degree of pleasurable excitement is, however, conducive to intellectual activity. It is, then, better to get work done by the offer of rewards than to get it done by the threat of punishments.

Résumé.

Feeling.

1. Feeling is a simple fundamental activity, and is, therefore, incapable of definition.
2. It is the pleasurable or painful state of mind accompanying intellectual activity.

Kinds of Feeling

1. *Sensuous* feelings are those accompanying immediately the exercise of the senses.
2. *Intellectual* feelings are those which arise from the higher intellectual activities.
3. *Æsthetic* feelings are those which connect themselves with the idea of beauty.
4. *Moral* feelings are those connected with our judgments of what is right and good, or of what is wrong and bad.

Relation of Feeling to Intellect.

1. Feeling is in a sense dependent on intellect, as it takes its rise in some intellectual activity.
2. Keen feeling as being a mental activity is so far antagonistic to intellect.
3. Feeling biasses the mind in favour of certain conclusions, and is for this reason a hindrance to intellect.
4. Pleasurable feelings react on the intellect and form a motive for continuing the activity from which it springs.
5. Many of the higher feelings are possible only with a high stage of intellectual development.

Attention is given only in consequence of some form of interest.

Interest is Pleasurable or Painful.

1. Pleasurable interest.
   - *a. Direct* when the pleasure is in the act itself. This is the kind of interest which is especially characteristic of childhood.
   - *b. Indirect*, when the interest is derived from the hope of benefit as a result of the act, and not from the act itself. Indirect interests are characteristic of adult life.
2. *Painful interest*. This is always indirect. Painful interest should be avoided as far as possible.

CHAPTER XXI.

THE WILL.

In Chapter IV. we have already seen that every mental state involves three factors.

By direct observation of any state of mind we find :—

1. That we are aware of a certain change in our sensations, thoughts, or circumstances.
2. That we are pleased or pained with the change ; and
3. That we act accordingly.*

All states of mind have then an *active* aspect. The word *will* in its broadest sense denotes everything that belongs to this active side of mind, that is, all active operations of mind. The word *will* is, however, often limited to those active mind operations that involve intelligence and choice. *Volition* may be regarded as a synonym of will in this narrower sense, and the term *conation* as a synonym of will in the broader sense. Thus, if a fly be seen coming towards the eye, the lid is instantly lowered. Such an action comes under *conation* but not under *volition*, for it is involuntary, since we cannot prevent the closing of the lid even if we will. Voluntary actions are *purposive*, that is, are directed to some end and involve choice.

The random movements of the new born child are not volitional though they are conations. Since a volitional act involves an idea or representation of some end to be attained it is clear that such an act is possible only when the mind has made considerable progress in its development.

---

* Dr. Ward. Art. Psychology in Encyclopædia Britannica.

An act of volition is highly complex, as is easily seen by analysing any such act. Consider the case of a man sitting so near a fire that he finds himself too warm and in consequence moves his chair away. Here we have a complete voluntary act in which we can distinguish at least the following elements:—

1. *Feeling* and what feeling involves. The man feels a certain amount of discomfort.
2. *The removal of this feeling of discomfort* is regarded as desirable.
3. He *perceives* that the cause of the discomfort is proximity to the fire.
4. He *represents* to himself a means of getting rid of or at least of diminishing the evil, viz., by the removal of his chair to a greater distance from the fire.
5. He *wills* to carry out such action. This is strictly the *volition.*
6. He finally removes his chair.

These successive stages may on analysis be discovered in every voluntary act, however simple such act may at first sight appear to be.

In the above analysis of a volitional act, stages 1 and 2, (that is feeling and desire) are fundamental elements. Desire itself is a complex mental activity. In every state of desire there is present to the mind a representation of that which is desired. Every act of desire is then in part intellectual. Representation is the work of the memory or of the imagination, and cannot be carried on without the use of these faculties.

In desire there is also an element of *feeling.* We desire only what is represented as pleasure-giving, and such representation is accompanied with a certain amount of pleasure. If we represent to ourselves something as pain-producing we experience a feeling of *aversion.*

When a mental representation is associated with pleasurable and also with painful ideas a conflict arises between desire and aversion, producing a state of uncertainty and hesitation. While this state lasts we do not even desire still less *will,* to obtain what is represented. Before willing in such cases we *deliberate,* that is weigh in our minds the good with the evil that clings to the representation. If the good outweighs the evil we desire what is represented, and straightway by a voluntary act strive to obtain it. The *deliberation* ends in *choice;* the choice in *desire;* and desire in *will.*

Whether the will is able *of itself* to make this choice or not, is the long and much debated question of the freedom of the will.

Libertarians say that the will is free or able to make its own choice, while those who say that the apparent power of the will to choose is determined entirely by circumstances are called *determinists.*

Although the will is determined by circumstances yet it possesses the power, to a certain extent, of making the circumstances. Were this not the case there could be no such thing as *moral responsibility.* A discussion of this point would, however, be out of place in an elementary work of this kind.

This will power, like all other mental powers, is a matter of development. Since every voluntary act involves a representation, it is clear that those who have little or no power of representation have little or no power of will. A *representation* is a revival of a presentation, or a complex structure formed of many presentations. The infant is continually receiving sense-impressions or presentations, but has for some considerable time very little power of re-presentation, and hence little or no will power. An infant is almost will-less.

The development of the germ of will power depends upon the development of the intellectual faculties. The voluntary actions of young children are directed to the gaining of some immediate pleasure or the avoiding of some immediate pain; but as he grows older he becomes more able to represent to himself events of the distant future, until when adult he carries out voluntary acts, the pleasurable result of which he will experience only after the lapse of years. This is the case, for example, with the student who sets himself steadily to prepare for a distant examination, or the man who while young denies himself present pleasures in order that he may make provision for old age.

It is evident that this power of determined action is of the utmost importance to every one. Like every other power the will improves by exercise. Hence it is very important that the teacher should endeavour to induce his pupils to the performance of voluntary actions. To do this interest of some kind must be aroused.

Résumé.

I. **Will.**—Definition :—

- *a.* In its broadest sense denotes everything that belongs to the active side of mind. *Conation* denotes the same.
- *b.* In narrow sense, will denotes those active operations involving intelligence and purpose. *Volition* is a synonym of will in this sense.

II. **Elements of a Volitional Act** of removing from too close a proximity to the fire.

1. Feeling and what feeling involves.
2. Desire of some end.
3. Perception of cause of discomfort.
4. Representation of the means to bring about the desired end.
5. The resulting act.

III. **Desire.** In a state of desire there is :—

1. A representation of something regarded as a good, which involves intellectual activity.
2. Feeling.—Only what is regarded as pleasure giving or pain removing is desired.

IV. **Aversion** is the opposite of desire. Aversion is a state of repulsion ; desire is a state of attraction.

V. **Freedom of Will.**

1. Determinists say that the will is altogether governed by circumstances over which it has no control.
2. Libertarians say that the will has a power of choice independently of circumstances.

CHAPTER XXII.

ATTENTION.

By attention is usually meant the concentration of consciousness by a fiat of will in order to accomplish some aim. Diffused consciousness is like diffused sunlight; attention by an act of will is like focussing the rays of sunlight with a lens; and as sunlight when focussed on a small area will effect (*e.g.*, set fire to a piece of wood) what the diffused light would never do, so consciousness when concentrated by attention, will accomplish what diffused consciousness never could. The senses are continually presenting to the mind messages of all sorts concerning what is going on round about us. It is the will which enables us to choose to which of these we shall at any moment attend. Had we not some such power our state of mind would be like that of one who is trying to understand everything that is said when a half-dozen people are talking all at once, a state, that is, of utter bewilderment, of chaos. Thus, at the present moment while writing this, there is near at hand a noise of birds twittering. I have the power, however, of at will ceasing to hear them and of concentrating my consciousness on what I am writing, in other words, of attending to what I am doing. Paying attention is a voluntary act. I will to attend to a certain object and I do so by an effort of will.

The objects of the attention are not always parts of the external world; we can, and many of us often do, direct our attention to what is within ourselves. The study of Psychology is, as we have seen, in the main the paying systematic attention to our own mental phenomena.

It is clear if, by an effort of will we can choose which of a number of simultaneous presentations shall receive our attention, that then the will has power so far to create its own circumstances, and is not, therefore, entirely determined by its circumstances.

Wonderful effects may be produced by a mind of (in other respects) only average power when concentrated by an act of attention. Above, the effect of attention was compared with the effect produced by a lens on diffused sunlight. Attention by focussing consciousness on a small area makes the impression more *distinct* and more *vivid*. Thus by attending to a slight sound we gain a much more distinct impression of it. A slight skin irritation, if we have nothing else to do but attend to it, becomes unbearable. On the other hand, even acute physical pain may be disregarded by concentrating attention on something else. Dr. Carpenter in his "Mental Physiology," says:—"The writer (*i.e.* Dr. Carpenter) has himself frequently begun a lecture whilst suffering neuralgic pain so severe as to make him apprehend he would find it impossible to proceed: yet no sooner has he, by a determined effort fairly launched himself into the stream of thought, than he has found himself continuously borne along without the least distraction, until the end has come, and the attention has been released; when the pain has recurred with a force that has over-mastered all resistance, making him wonder how he could ever have ceased to feel it."

Unless we pay some attention, whatever the stimulus may be, the mind does not become conscious of it. In the above quoted case of Dr. Carpenter, he ceased to attend to the pain and consequently ceased to feel it. The soldier in the excitement and concentration of his whole mind on the attack has no power of attending to anything else, and may be wounded even to the death without at the time being conscious of it, the pain making itself felt only on the relaxation of the mind from its state of intense concentration. Every teacher knows that when a boy is not attending—or rather attending to something else—he knows nothing of what is being done in the class, though the same physical stimuli reach him as reach the rest of the class.

Again, the smaller the area on which the rays falling on a lens is concentrated the more intensely illuminated and heated is such area ; so with the attention the smaller the extent to which we limit our attention, the more vivid and distinct is the knowledge gained. Diffused consciousness can at best give but hazy knowledge, while consciousness concentrated by an act of attention on a small area gives clear knowledge.

It is of the greatest importance to the teacher to clearly understand on what the power of attention depends. In the first place, it depends upon strength of will. The fixing the attention is essentially an act of will, and being such, the power of attention must, other things being the same, vary as the strength of will. Hence, too, whatever increases strength of will also increases the power of attending to any given stimulus. This is not, however, the whole of the matter, for the will power varies not only in different individuals but in the same individual at different times. This variation depends on two things :

1. The amount of disposable energy, and
2. The strength of the stimulus.

No mental work can be carried on except at the expense of a supply of force stored up in the nervous matter of the brain. This force is generated by the chemical re-actions taking place between the blood and the nervous tissues. The very word *attention* (literally a *tension* or *stretching towards* something) implies effort. Effort of any kind is exhausting. Hence, if the brain be exhausted of its supply of energy, attention is impossible. With a partially exhausted brain attention is possible, but the effort needed is greater in proportion to the degree of exhaustion. Every student knows how much more difficult it is to control the attention when tired out than it is when fresh.

It should be noticed that the giving attention is in itself an effort irrespective of what is accomplished by it. Nothing "takes so much out of us" (to use this most expressive phrase) as a long continued effort to make out the words of an almost inaudible speaker. Interest in the subject may keep us during the time unconscious of the strain, but at the end we feel tired out. The *recreations* of students should be of such a nature as not to exact great concentration of the attention, otherwise they are exhausting and cannot serve the purpose of recreation. Such a game as chess is an excellent means of mental training, but is of too severe a nature for a recreation. Even such a subject as music may be too absorbing to be a good means of recreation. Many a one finds that an evening's music instead of recreating tires exceedingly. Two requisites are essential in an excellent form of recreation:

1. It must take the one seeking recreation into a new world, so as to form a complete change from those circumstances which have caused the fatigue. Chess and music certainly fulfil this condition.
2. It must not exact a very close and long continued concentration of the attention. In this respect chess fails, and music may do so.

It is evident that every one must have certain times for recreating themselves, that is, for replenishing their diminished stock of disposable energy. Sleep is, of course, the best restorer, as the mind is therein (if dreamless) absolutely at rest. In the morning after a long night's rest our stock of energy is a maximum, and hence the early part of the day is the time when the most severe mental work can be done.

Granted a given amount of disposable brain energy, it is the relative strength of the stimulus that decides whether or not attention be given to it. The strength of the stimulus depends immediately on:

1. Its quantity.
2. Its quality.
3. Its suddenness.

A physical stimulus that is intense will catch the attention when a slight one will be disregarded. Thus, while a slight sound may be quite unnoticed, a loud one forcibly attracts attention. So a brilliant light, a strong taste, a pungent smell, or a great pressure will catch the attention.

The quality of the stimulus has also much to do with its attention-attracting power. A beautiful melody would almost certainly catch the attention, while a commonplace one might be unnoticed.

Many stimuli retain the attention when once roused, because the impressions produced immediately call up into consciousness associated pleasurable ideas, It is impossible by a single effort of will to attend for any length of time to one single idea; whenever this is apparently accomplished, the explanation is that new connected ideas are continually suggested to the mind, and these are attended to by successive efforts of will.

The suddenness of a phenomenon has great influence on its power as a stimulus to attention. It was well said by Hobbes—"always to have the same sensation and to have no sensation at all is the same thing." To perceive is, as we have already seen, to become conscious of change and recognise its cause, and without some attention an act of perception is impossible. Change of stimulus is absolutely essential to rouse attention. The more sudden the change is, the more surely will it catch the attention.

On the other hand a change of stimulus may take place so gradually as never to attract attention, and is therefore unperceived. Thus, for instance, one may be in a room the air of which has become very "stuffy," and may remain quite unconscious of the need of a supply of pure air, because the change in the air from purity to stuffiness has taken place very gradually. But any one coming into the room from the open air notices it at once, the change to him being sufficiently sudden to catch the attention. This explains why it is that as a rule novelty is pleasurable. It keeps the attention active and the use (not the over use or abuse) of any faculty is always a source of pleasure.

Novelty alone, however, is insufficient to keep the attention for long. After having a continued succession of novel experiences we soon begin to long for the familiar. For instance, it gives the keenest pleasure to hear English spoken after being abroad and hearing nothing but foreign languages for any length of time. It brings to mind, by association of ideas, so many of our past experiences that it not only catches the attention but keeps it for a considerable time.

In order that the attention may be held for any length of time, it is essential the object which rouses the attention must be able to keep on suggesting ideas from our past. The past life of a man may in a large measure be gauged by becoming acquainted with his permanent interests. The artist's attention is instantly caught by any reference to art, the musician's by any reference to music, the teacher's by a reference to teaching, and so on.

Different acts of attention may be classified by considering the relation in which they stand to will. We have already seen that the giving the attention is usually the result of an act of will, that is, it is a voluntary act. We will, or as we often say we "make up our mind" to attend, and we attend in consequence. The will decides which of the numerous sense impressions constantly being transmitted to, or which of the ideas as constantly being suggested in the brain shall be attended to. The stimulus is at least in part an internal one. This power of giving *voluntary attention* is characteristic of a high stage of will power.

The earliest attention which a child gives is of a *non-voluntary* kind. It has nothing to do with the will and is at the mercy of circumstances. Non-voluntary attention is characteristic of infancy. The child's attention is roused by whatever objective stimulus is presented to it at the moment. He can no more resist having his attention called to any stimulus than the adult can resist closing his eye-lid on seeing a fly approach the eye. The action in both cases is automatic or reflex; will has nothing to do with it. Given the stimulus, the action follows as certainly as does that of an automatic machine when a penny is put in the slot.

There is still a third form of attention familiar to every adult, who experiences it whenever he attends to something in spite of determining not to do so. This is *involuntary* attention. A good example is the case of a tune that so "gets into one's head" that it is impossible to get rid of it. In many such cases one determines to hum it no more, and immediately after he finds himself still humming it. A chain of ideas in such case persists in rousing the attention in spite of an effort of will. So, too, when weighed down by a great grief, do what one may, for a considerable time consciousness is absorbed by the one idea, attention is involuntarily given to it. In such cases the will can in time gain the victory by resolutely determining to think of something else.

The relation between these different forms of attention and the will may be briefly expressed thus:—Attention is *voluntary* when given as the will directs, *non-voluntary* when given without the interference of the will, and *involuntary* when given in opposition to and in spite of the will.

The power of giving attention is, like every other faculty, a matter of growth and development. At first, as above said, attention is reflex or non-voluntary, and is entirely at the mercy of external stimuli. While this is the case the child can hardly be said to have any attentive *power*. But in every act of attention, perhaps the very earliest, there is a germ of volition out of which springs the power of exercising voluntary attention. A stimulus will only call the attention, not *keep* it. Voluntary attention is an effort which will not be given unless sufficient intellectual power is possessed to represent to oneself at least the idea that some gain will come from attending. Directly the child will watch for something to happen, as he does, for instance, in the childish game of "Peep-bo," there is, however small it may be, a real power of voluntary attention. Once begun this power is being continually exercised, and grows in consequence until ultimately one has the power of fixing attention on one idea to the exclusion of every other. There remains, however, a tendency to reflex attention, such tendency being in any case overcome by an act of will. The tendency to reflex action persists and places a limit to the power of voluntary attention. No one ever gains such a power of voluntary concentration of the attention as to be able to effectively resist any and every external stimulus. With some the attention remains almost entirely reflex throughout life. We all know such old children who cannot concentrate their thoughts on any one thing, in whose mind the flow of ideas is absolutely at the mercy of association of ideas, and who in conversation skip from subject to subject as a bee flits from flower to flower.

The complete control of the attention may be regarded as the power of at will attending to a given stimulus, or as a power of resisting the allurements of other stimuli. The highest form of voluntary attention is seen in its concentration on what is in itself uninteresting.

We never attend to anything which is in no way interesting to us. The interest may not be directly in the thing itself, but indirectly through associated ideas. The interest during childhood is nearly all of the direct kind. A child cannot, for instance, study a subject which is in itself distasteful merely because the knowledge of such subject will afterwards prove of advantage. As experience widens, however, the child gradually gains the power to represent vividly to himself the advantage that a study, in itself unpleasant, may bring. The study then possesses an indirect or derived interest which stirs up the will to make the necessary effort for voluntary attention. The interests that call for the voluntary attention are always indirect.

In school work, the younger the children are the more necessary is it to make them directly interested in what they are doing. It is vain to expect to get them to work hard by telling them that by so doing they will gain some advantage in the (as it seems to them) far distant time, when they will be men or women. It is important for the teacher to note that the power of giving voluntary attention at will is developed out of the non-voluntary attention given by the child.

This power of concentrating the attention on whatever may be presented to him is one of the most valuable acquisitions that a human being can acquire. Many great men have even gone so far as to say that this is the *essential* essence of genius. There can be no doubt that a genius has the power of giving almost unlimited attention to that particular subject for which he possesses genius. The attention given by a genius is, however, often of a non-voluntary, rather than a voluntary kind. The genius is seldom able to concentrate his attention on any subject at will—his power of concentration applies only to the subject for which he has a special aptitude. This is the explanation of the fact that great geniuses so often lack common sense.

Résumé.

I. **Attention.**

1. *Attention* is concentration of consciousness.
2. *Will* decides which of numerous competing impressions or ideas shall at any moment be attended to.
3. *This power of the* will to choose enables it to make its own circumstances.

II. Effects of Attention.

1. It condenses consciousness as a lens focusses rays of light and heat. This makes impressions :—
   - *a.* More distinct. *b.* More vivid.
2. It enables us to disregard impressions or ideas. It does this by fixing the whole consciousness on other impressions or ideas.
3. The smaller the area to which we limit the attention, the more distinct and the more vivid does that area become. This may be called the *Law of Attention.*

III. The power to attend depends on—

1. Strength of will.
2. The amount of disposable energy. Giving attention is an effort, and as such uses up energy. Best forms of recreation *divert* but do not *exhaust.*
3. The strength of the stimulus. This depends on—
   - *a.* Quantity. *b.* Quality. *c.* Suddenness.

   Sudden changes rouse attention when gradual ones do not. Hence novelty is pleasurable. Novelty soon palls and the familiar becomes a powerful stimulus. Continued attention can be paid to the novel only when it continually suggests the familiar.

IV. Kinds of Attention.

1. Attention is called *voluntary* when given to what the will chooses.
2. It is called *non-voluntary* when the will has nothing to do with it.
3. And *involuntary* when given in opposition to, in spite of the will.

V. Kinds of Stimuli.

1. *Direct* when the interest is in the object itself to which the attention is given.
2. *Indirect* when the interest is in something associated with the object of attention.

VI. Genius.

1. Has been defined as an unlimited power of paying attention, but this is only partly true, for
2. Geniuses as a rule cannot attend to *anything* at will for any length of time—their great power of attending is only for those particular things for which they are geniuses.

CHAPTER XXIII.

HABIT.

Habit may be defined as a fixed disposition to think or act in a particular way. With all but the very young of the human race habit is of vast influence, and even the very young are rapidly coming under that influence. Any one who will think over his week's work will see that a large part of it is done more or less under the influence of habit. "Habit is second nature" someone said in the hearing of Wellington; "Second nature" replied the Duke, "habit is ten times nature"; and from his point of view as leader of an army, whose every movement is mechanical, he was right. We are all the creatures of habit, though we may not like to own it for fear of being thought "old fogies." If the teacher really thinks that his work is, as far as in him lies, to permanently mould the characters of his pupils, then it is very necessary for him to study in every possible way habits and their formation, for character is a complex whose elements are habits.

In the first place it will be well to consider what is implied in the formation of a habit. We have already seen that every experience we have modifies us in such a way as to make a similar experience a matter of less difficulty in the future. Is it the body or mind that is so modified? Both, but the body directly and the mind indirectly. Hence the formation of habit may be regarded largely if not mainly as a *material* fact. The brain (like other material things) is capable of undergoing structural modifications given a modifying force. This is what is known as the *plasticity* of the brain. A few examples of similar modifications in material structures will make this clear. Every one knows that a pair of old boots are much more comfortable than new ones. A new boot never has the exact shape of the foot; every time it is worn, however, force is applied which tends to make it more accurately fit the foot. The boot possessing a higher or lower degree of plasticity gradually responds to this modifying force and takes up "a fixed disposition" to fit the foot; in fact it forms the *habit* of acting in that particular way we call "fitting the foot." So a suit of clothes gradually forms the habit of adapting itself to the form of the wearer. Again, a piece of paper by being folded, undergoes such a modification of structure as makes it *tend* to fold in the same way again.

What takes place in the brain in the formation of any habit is in an exactly similar way, a change of structure inducing a *tendency* to take up a particular form of activity. This is admirably expressed by Dr. Carpenter when he speaks of the nervous system as "growing to the mode in which it is habitually exercised."

This growing to the mode of habitual use may be regarded as the formation of more or less paths for the discharge of the nervous energy of the brain. A nervous disturbance is transmitted along an afferent nerve to the cerebral hemispheres and there calls forth consciousness followed by an act of will, producing a disturbance which is propagated along an efferent nerve to some muscle which in response to this stimulus performs some movement. After this has taken place a greater or less number of times, the disturbance of the afferent nerve results in a disturbance of the efferent nerve and consequent muscular movement *without the intervention of the will.* The whole activity is then essentially reflex. The habit is said to be formed when, given the stimulus, the resulting activity is purely reflex. The winding up of one's watch may be taken as a good example. After a time the whole activity involved in this becomes entirely reflex. The time of night, the feeling of tiredness, the going to our bedroom, the sight of the bedroom, etc., all combine to form the stimulus which is at once responded to by winding up our watch. So reflex is the action that immediately after winding it up we sometimes begin to wonder whether we have wound it up or not. During the winding in such cases the mind has been engaged on something else to such a degree that the winding was an *unconscious* activity.

It is clear that the formation of any habit represents a loss of plasticity on the part of the brain, for it consists of a more or less permanent modification of the brain. Just as the boot that has been modified so as to fit one foot loses to a large extent the power of further modification. Further, even if the brain never suffered any permanent modifications of structure it would lose its plasticity as a natural consequence of the cessation of growth and (later) commencement of decay. Childhood and youth then are the proper periods for the formation of habits, the formation of which in middle and old age is almost impossible. When an adult sets himself to acquire a new habit he has first of all to unlearn a previous habit which the new one is intended to replace, that is, a certain definite fixedness of brain structure has to be destroyed. To accomplish this, an effort of attention and an exercise of will power must be exercised whenever the stimulus to the habitual activity is present. If the attention and the will be inactive the old action is sure to follow the stimulus reflexly. The old habit overcome once, is not overcome for ever, but will spring up again instantly the attention be withdrawn. This is beautifully allegorised by Tennyson in the Idyll "Gareth and Lynette" when he makes Gareth contend with and overcome Evening.

> "And Gareth overthrew him, lighted, drew,
> There met him drawn, and overthrew him again,
> But up like fire he started; and as oft
> As Gareth brought him grovelling on his knees,
> So many a time he vaulted up again;
> Till Gareth panted hard and his great heart,
> Foredooming all his trouble was in vain,
> Laboured within him, for he seemed as one
> That all in later, sadder age begins
> To war against ill-uses of a life,
> But these from all his life arise, and cry,
> Man hast made us Lords, and canst not put us down."

This extract suggests that habits are not always helpful to us. It is well to consider what habits do for us. In the first place habit makes easier, more accurate and more simple the muscular movements requisite for the accomplishing a definite result. That the movements become *easier* is evident from the fact previously stated that the will is to a greater or less degree dispensed with. When the learner of the violin sees a Joachim play he is always struck with the ease with which it is done. So too with regard to accuracy. The skilful player not only plays with ease but with greater accuracy than does the tyro. After much practice the *fingers remember* exactly where to go to produce the note required. Then with regard to simplicity of movement, the greater the skill (which is a question of habit) the fewer the muscles called into play to produce a given result. The skilful violinist performs the movements necessary in bowing almost entirely by the wrist and fore arm, but the beginner always moves his whole arm. The beginner on the piano moves his whole body to accomplish what can easily be accomplished simply by wrist movement. Further, habit as before mentioned diminishes the necessity for conscious attention and will. Clearly then the establishment of habits *may be* of immense service to us.

There is, however, another side of the question which must not be overlooked. If the habit formed be a *bad* one it is a standing temptation to the performance of some bad action. The teacher and parent cannot too well remember that the Law of Habit applies to the formation of bad as well as good habits. Every performance of an action, good or bad, leaves us more fitted for the performance of such action than it found us. And further, even though the habit be not in itself bad, still it may prove a hindrance to us. This is the case whenever we have thoroughly adapted ourselves to a certain position in life and are then transferred to another, in which an altogether new set of activities is called into play. The establishment of habits always carries with it a loss of power to adapt ourselves to new circumstances—a loss that is always a matter of regret.

Hence the teacher should pay the greatest attention to the formation of those habits which will not need to be unlearned whatever position in life the pupil will hereafter occupy. Habits of truthfulness, honesty, punctuality, orderliness, good manners, industry, concentration of attention, etc., are useful in every position in life.

The formation of such habits is perhaps the most important part of education, and is rightly insisted on by all educationists.

To form habits which are in themselves good and are serviceable in all positions of life is to make an ally of our nervous system instead of an enemy.

Perhaps the greatest merit in Locke's "Some Thoughts concerning Education," lies in the insistency with which he inculcates the importance of the formation of habits. "For that," says he, "which I cannot too often inculcate is, that whatever the matter be, about which it is conversant, whether great or small, the main (I had almost said only) thing to be considered in every action of a child, is, what influence it will have upon his mind; what habit it tends to, and is like to settle in him; how it will become him when he is bigger; and if it be encouraged, whither it will lead him when he is grown up."

The strength of a habit may be gauged by the certainty and readiness with which the action is performed on presentation of the stimulus. When a habit is perfectly formed, the action not only follows with certainty, but *immediately* follows the stimulus. Perhaps a more practical way of telling the strength of a habit in oneself, is to note whether the habitual action is carried out unconsciously. The more unconscious the action is, the more nearly does it become reflex. If purely reflex, then the habit is a strong one. The following are, according to Professor Sully, the three conditions on which the strength of a habit depends:—

1. The amount of motive force brought to bear and of attention given at the outset to make the action perfect.
2. The frequency with which the action has been performed.
3. The uniformity or continuity of its performance in like circumstances."

To these we may add a fourth.

4. The degree of plasticity of the brain at the time of formation of the habit.

With reference to (1), it is evident that the greater the care and attention given to the performance of the action at first, the more quickly will be gained the power of doing such action quickly; the easier an action becomes, the more nearly established in us becomes the tendency to such action. Thus in learning to hold the violin correctly, one who does not take pains to hold it correctly at the outset, will very likely never get into the habit of doing so.

The second condition is also an evident one. If the formation of a habit consists of making more or less permanent a particular brain modification, and if any given action makes the brain take up that modification and leaves a tendency, however slight, towards its permanent establishment, it is clear that every repetition will deepen such tendency until it becomes permanent. Hence the necessity of repetition in endeavouring to establish a habit. One action no more makes the habit than " one swallow makes the spring."

Further, the brain is modified by any new action, but after the action ceases the modification caused by it tends to become more or less rapidly evanescent. If then the action be not repeated before the modification has entirely disappeared it will clearly have no cumulative effect, *i.e.* it will not add a new effect to the previous one, for the previous one has vanished. The total effect is merely the effect of the last action. If, however, the second effect happens before the disappearance of the first there will be a cumulative effect, making a real advance towards the formation of the habit. Hence Professor Sully's third condition. That the fourth is an important condition is clear from what is said above.

The most important things for the teacher to attend to after having settled what habit he intends to endeavour to form in his pupils are:—

1. Make them pay sufficient attention to note exactly what has to be done.
2. Take care to have the action repeated many times.
3. Let the repetitions be separated from one another by no long intervals of time.
4. Never suffer the action to be omitted in the presence of the stimulus. One omission will undo the work done by many repetitions.

Full discussion as to what habits it is advisable to try to form in children belongs to Ethics rather than Psychology.

Résumé.

I. **Habit**:—

1. Def.—A fixed tendency to think or act in a particular way.
2. Habits play a large part in the daily life of every one.
3. Hence the necessity for teachers to study the formation of habits.

II. **Twofold nature of habit**:—

1. The formation of a habit always involves a modification of brain structure, *i.e.*, it is *physiological.*
2. And it involves a corresponding change of mind, *i.e.*, it is psychological.
3. The modification in both cases causes a tendency towards the habitual activity.

III. **Habitual action is reflex**:—When a habit is thoroughly formed, then the activity is purely reflex, there being no intervention of the *will.*

IV. **Disadvantages of habits**:—

1. The more habits we contract, the more we lose the power of adapting ourselves to new circumstances. The formation of a habit as involving a tendency to act in a particular way necessarily also involves a tendency to resist action in any other way.
2. A *bad* habit when once formed is a standing temptation.

V. **Advantages of habit**:—

1. Habit makes *easier*, more *accurate*, and more *simple*, the muscular movements required to accomplish a definite result, and
2. Diminishes the necessity for *conscious attention* and *will.*

VI. **When habits should be formed.**

While young, for several reasons:—

1. Because the brain during the period of youth is more plastic, and

2. Because no habits have to be then unlearned. Unlearning is always more difficult than learning, and
3. Because children can be made to acquire certain habits by the exercise of the parent's or teacher's authority, which is, of course, impossible later in life.

VII. What habits the teacher should try to form in his pupils.

Those actions only which are likely to be *always* useful should be made habitual. No habit should, if possible, be formed which there is any great probability of having to unlearn.

VIII. Tests of the strength of a habit.

1. The certainty with which the action follows the stimulus.
2. The readiness with which the action follows the stimulus.
3. The degree of unconsciousness with which the action is performed.

IX. Conditions on which strength of habit depends.

1. Amount of motive force and of attention given at the outset.
2. The frequency with which the action has been done.
3. The uniformity or continuity of its performance.
4. The degree of plasticity of the brain at the time of the formation of the habit.

X. Practical hints to teachers.

1. Make the children pay sufficient attention to note exactly what has to be done.
2. See that the action is frequently repeated.
3. Let the repetitions be close together.
4. Never suffer the action to be omitted.

CHAPTER XXIV.

MENTAL DEVELOPMENT.

That the mind of the child is different from the mind of the adult is a fact known to everybody. The difference is so striking that it could not possibly escape general notice. That it has not escaped notice is clear from our common language, which uses such words as child-like, boy-like, man-like, to denote acts regarded as characteristic of the *child*, the *boy*, and the *man* respectively. Moreover, every such word is applicable and applied not only to *intellectual* acts, but to manifestations of *feeling* and of *volition* as well. The adult mind is vastly different in all its phases from the infant mind. The difference, however, is not so much one of kind as of degree. The mind of an adult is the same as that of the same person when a child, but in a more highly developed condition. As the oak tree is the same being as the embryo in the acorn from which it sprang, but in a far more highly developed state, so the adult mind is the same mind as that of the embryo from which it has sprung, though more highly developed.

The student should carefully note the difference in meaning of the terms *growth* and *development*. Material things are said to *grow* when they increase in bulk or mass, and are said to *develop* when they increase in functional power, that is, when they improve in capacity for doing the work which they have to do. As a rule growth and development go on together, but not always. Thus the human brain grows rapidly during the first seven years of life, after which growth is very slow; its development does not proceed *pari passu*. From the seventh to the fourteenth year the development is more rapid than during the first seven years. To take another example. Watches have, during the last hundred years, greatly decreased in size, and yet during the same period, they have greatly developed, for they perform their work of keeping time much more accurately now than they formerly did. This distinction can be applied to the intellectual phase of mind, which may be said to grow as its stock of knowledge increases, and to develop as its power of acquiring fresh knowledge improves.

Memory has most to do with its growth, while in its development, reason is the chief factor.

On this distinction is based the antithesis between *mere instruction* and *education.* To educate is essentially to help on development, while in instruction the chief idea is the imparting of information, or the increase of knowledge. But after all, the distinction is not so decided as is often made out. It is impossible to educate without instructing, and it is equally impossible to instruct without in some degree improving faculty. The important point for the teacher to note is, that in teaching, the right thing is to fix the mind on education rather than on instruction.

Many writers make each successive stage of development to occupy seven years ; thus, the first seven years of life form the first stage ; the second seven years (*i.e.*, from 7 to 14) form the second stage ; and the third seven (*i.e.*, from 14 to 21) form the third stage. To these we may add a fourth stage occupying the fourth seven years (*i.e.*, from 21 to 28). It must be carefully noticed, however, that nature does not draw hard and fast lines between these different stages. Many children in the eighth year are not more developed than others in the seventh. Nor must it be supposed that in a child there is a sudden leap in development at the end of the seventh year.

Still after making due allowance, it remains true that these different stages have broadly their own charactistics.

The First Period.—During this period—the period of infancy—the infant is the mere creature of circumstances. The mind is acted upon by, but has little or no power of reacting on, the surroundings in which it is placed. The *objective* element is the more important factor in its mental life ; the *subjective* element is gradually being awakened and called into activity.

The actions of the infant are mainly of the nature of reflex action. He cannot help responding in a definite and predictable way to the stimuli that act upon him, and the response is instantaneous. His knowledge is mainly of the presentative kind, reaching the mind through sensuous-perception. In the later part of this period memory and imagination become active, giving the power of representative knowledge. Even to the end of the period, conceiving, judging, and reasoning, can be carried on only in a most rudimentary fashion.

It follows, as a consequence, that during the first seven years of life education should be directed mainly to the "training of the senses," or rather to the training of sensuous-perception. Since sight and touch are the most important of the intellectual senses, the training of the hand and eye should specially be attended to.

Another evident consequence of what is said above is that the infant lives in the present. To think of the past we must use the representative faculty of memory; to think of the future the power of imagination is requisite. These faculties are almost absent, at least in the early part of infancy. Further we can form an idea of a future only by forming a combination of elements out of the past. But the child has little or no conscious past. Hence they are necessarily creatures of the present moment. This is perfectly clear to any one who has in the least observed children. The feelings of infants are of a simple kind, being mainly those immediately connected with sense perception. The more complex feelings depend largely upon the representative faculty and are, therefore, unknown to the infant, who possesses this faculty in at most but a rudimentary form. The feelings of infants are moreover of short duration, but intense while they last. The continuance of a definite feeling (anger for instance) is impossible without a continuous representation of the cause of the feeling. Infants are too much subject to the stimuli of sensuous perception to be able to think long of the cause of the feeling. Hence their states of mind are transitory, one minute they are all tears and the next all smiles. For the same reason, while they last, their feelings are all absorbing. The infant cannot alleviate his feelings by thinking of their cure, or of the time when they will cease, or by comparing them with still more painful feelings of others. The only effective way of making an infant's feeling to cease, is to distract his attention to some object that acts as a stimulus to sensuous perception.

Another consequence of what is said above, is that an infant's feelings are selfish.

To have *unselfish* feelings one must *represent* to himself the feeling of others, and as we have seen, this power to represent is absent in infancy.

During the first period the *will* is almost inoperative. Infants are *will-less.* This is often the case, even with infants who are regarded as *wilful.* An infant who is carried away with the intensity of his feelings, does not thereby exhibit a great will power, which renders him stubborn, but rather a will power so small as to have no effect. The restlessness and activity of infants are largely due to the absence of any controlling will power. Infants instantly respond to whatever stimulus acts upon them.

To pay voluntary attention is, as we have seen, to exert an effort of will power. As infants possess but little will power, it is useless to expect them to attend to any one thing for any length of time. Hence, lessons in infant schools must be of short duration, and must be made so interesting that the attention given by the infants may be of the *non-voluntary* kind.

During the first stage *feeling* is the dominant factor in consciousness. It must not, however, be supposed that will is entirely absent. Much of the training of the will during this stage consists in leading the children to restrain their feelings. Thus the infant in the Kindergarten has to restrain the impulse to individual activity. He has to learn, even when active, to exercise his activity along with, and in the same way as, many others. This cannot be done without an exercise of the will.

During the latter part of the first stage, though the child is still weak in futurity, much may be done in training the will by leading them to see that a restraint of present feelings will be productive of future pleasure. The child, who at the age of six, will drink unpalatable medicine, because he is told it will prevent pain has already gained a considerable amount of will power. So, too, the child who will save some of his sweets that he may eat them to-morrow, shows a power of controlling present impulses by an effort of will.

Children learn to exercise the will much more quickly when much with other children than when brought up almost entirely apart from others of about the same age.

Résumé.

I. Mental Development.

1. Development is implied in the use of such words as *child-like*, &c.
2. Such words apply to *cognition*, *feeling*, and *will*.
3. The mind remains the same mind in all its stages of development.

II. Growth and Development.

1. *Growth.*
    - *a.* *Growth* of material things is increase of bulk or mass.
    - *b.* *Growth* of mind is increase in its store of knowledge.
    - *c.* Instruction has for its object mind-growth.
2. *Development.*
    - *a.* *Development* of mind is its increase in the power of gaining fresh knowledge, and of applying old knowledge.
    - *c.* *Education* has for its object mind-development.

III. Stages of Development.

1. First stage comprising first seven years.
2. Second stage, comprising second seven years.
3. Third stage, comprising third seven years.
4. Fourth stage, comprising fourth seven years.

IV. **First Stage.**—During this stage, the infant is the creature of circumstances, his mind is *passive* rather than *active*; the *objective* is of greater importance than the *subjective*; his activities are of a reflex character.

1. *Cognition.*
    - *a.* Mainly of presentative kind. *Sensuous-perception* is very active; *memory* and *imagination* become active towards the close of infancy; *thinking* is little used even at the end of the period.
    - *b.* Education mainly concerned with sense-training, especially hand and eye training.
    - *c.* Infant lives in the present.

2. *Feeling.*
    - *a.* Chiefly those connected with the use of the senses.
    - *b.* Feelings largely involving representative faculty necessarily unknown to infants.
    - *c.* Infants' feelings are of short duration, but
    - *d.* Intense while they last.
    - *e.* To calm children's feelings their attention should be distracted.
    - . Infants' feelings are selfish.

3. *Violition.*
    - *a.* Infants are will-less.
    - *b.* Restlessness and activity due to lack of will-power.
    - *c.* They are incapable of giving continued voluntary attention.
    - *d.* Their lessons should be short.
    - *e.* Will-training consists in gaining ability to control present feelings.
    - *f.* This is largely helped by being with other children.

CHAPTER XXV.

MENTAL DEVELOPMENT—*continued.*

The second stage of development, comprising the second seven years of life, is of the greatest importance to the teacher, and may conveniently be considered as consisting of two periods, the first comprising from the eighth to the eleventh year inclusive, and the second from the twelfth to the fourteenth.

In the first of these periods the child's mind is much less passive than in the first stage of development; it is not only acted upon by, but shows a much greater power of reacting upon, its surroundings. It is capable of making considerable use of the materials gained through sensuous perception and stored up during the first period. It is this stored up knowledge, and the exercise of faculty involved in its acquisition, that makes the subjective factor in all cognition much more important than during the first stage, though it is still of much less importance than the objective factor. What the child is during these years depends in part upon how he was trained during the first period. Both Pestalozzi and Froebel emphasized the fact that for education to accomplish its aim it must be perfectly carried out during every stage of development. The intellect is during this period rapidly developing. Sensuous perception is as active as in the first stage and begins to be regulated. The child begins to be able to observe an object with the intention of learning as much about it as possible. Especially is this the case when the child receives a course of "object lessons," and lessons on common objects as an introduction to lessons in elementary science. He gains a practical acquaintance with things much more complete than can possibly be possessed in the first stage.

The *memory* rapidly improves during this period, and much verbal knowledge is gained, which is of permanent service during the later stages. What is learned by heart during this period generally remains for life.

The *imaginative* faculty improves, though it becomes more restrained than in infancy. This restraint is largely due to wider knowledge. The child ceases to fancy himself a star because he *knows* it to be impossible. It is this wider knowledge, on the other hand, that forms material for the greater though more restrained working of the imagination.

During this period the conceptive power is rapidly improving. The child's greater practical knowledge of things makes him acquainted with classes of objects, concepts of which, more or less accurate, he necessarily forms. Conception is also vastly helped by the child's much greater command over language. This improvement in the knowledge of language is largely furthered by the ability to read without much difficulty.

The judging faculty is rapidly developing. During this period the child is constantly forming judgments about matters within his experience; he passes judgment on his lessons, his school-fellows, his teachers. Many of his school lessons call into play his faculty of judgment. Thus, after learning what an *adjective* is, he is called upon to *judge* whether certain words are adjectives or not. In fact, every act of classification necessarily involves an exercise of judgment.

It must not be supposed that the judgments of the child of from 8 to 11 years of age are always accurate. Much of the training of this faculty of judging may be carried on by inductive questioning of such a kind as to lead the child to see the faultiness of, and to correct, his inaccurate judgments. During this period the teacher has both to *repress* and to *encourage* the child to judge. Repression is needed where the child too readily (and almost necessarily inaccurately) judges on questions, a trustworthy answer to which is altogether beyond him. Thus, it would be quite wrong to allow young children to pass moral judgments on many acts that come under their notice. On the other hand, many children need encouraging to give judgments. In school work, for example, many children will readily say what they have learned by heart, who will not attempt to give an answer to any question demanding independent judgment.

The reasoning power is also rapidly developing during this period. The child in gaining a wider knowledge of individual things becomes capable of making more or less trustworthy inductions. This power is greatly helped by the teacher making all his teaching as inductive as possible. In such school subjects as grammar and arithmetic the child is exercised in the application of general rules to particular examples, or in deductive reasoning. The child's ever-widening experience supplies him with a greater store of materials on which to apply his reason. At the age of 11 years, however, the reasoning faculty is far from being completely developed.

During this period *feeling* becomes more and more under control. The child is not so "transparent" as the infant. The feelings become much more complex. They no longer consist almost entirely of the pleasure or pain accompanying acts of cognition.

These elementary feelings become greatly modified by having ideas associated with them. Higher feelings, which depend largely on the representative faculty, become more powerful. Feeling is no longer to such a degree as in infancy a matter of the moment; it is more or less modified by thoughts of the future or of the past. The child is more under the influence of the *subjective*. This largely influences the will. The higher development of the will, as manifested in what are properly volitional acts, depends mainly on the development of cognition and feeling. Volition is not exerted except under the influence of feeling; and feeling, as we have seen, becomes more and more dependent on cognition. The child becomes gradually able to exert himself to gain some future advantage. He is no longer so completely the creature of the circumstances of the moment. Thus, the child of ten will often make a great effort in the hope of gaining some prize or other, or in the hope of pleasing his parent or teacher; or a great effort will sometimes be made to avoid incurring some future pain. Hence the influence during this period of life of artificial rewards and punishments.

The second part of the second stage of development, comprising the years twelve to fourteen, may be regarded as coinciding with the final stage of primary school work.*

In sensuous perception the subjective factor becomes more and more important. If it be true that "the eye sees what it brings with it the power to see," it is evident that more can be seen at this period than in the earlier stages.

The observing faculty becomes much more regulated. The boy knows beforehand what to look for, and is able to concentrate attention on that.

During this period the power of memory is greater than at any other time of life. This is shown in the facility with which facts are acquired, and the tenacity with which, when once acquired, they are retained. Hence the importance of doing during this period of life as much as possible of the merely verbal memory work of life.

The imagination is now much more powerful, though kept under control. At the age of 14, boys are often extremely curious as to the cause of phenomena, and not infrequently acute in framing hypotheses to explain them. Especially is this the case with those who have been well-taught some branch of physical knowledge, such as chemistry.

The conceptive power is also greatly improved during these years. This is a necessary consequence of the widening and systematising of knowledge that goes on. The systematic study of the vernacular and of some foreign language is of great help in extending the stock of concepts and in rendering those already possessed more accurate.

The judgments formed become much more reliable. Most of the work of the school conduces to this result. It is of the highest importance that those who are leaving school at the age of 14 should have by that age acquired the power of judging promptly, and should have already formed a stock of stable judgments as to what is right and what is wrong. Many games do much to develop the faculty of judging. Such a game as cricket is of the highest importance in developing the power of judging promptly.

---

* The number of children who remain in the public elementary schools of England after they are 14 years old is very small, only about one per cent.

During this period the reasoning faculty is very largely exercised, and in consequence greatly improves. The degree of improvement depends largely on the kind of teaching; the old system of teaching, which consisted essentially in pouring knowledge into the scholar, did little to develop reasoning power. The teacher should remember that training is rightly developed practice, and that, therefore, the boy cannot learn to reason except by reasoning. The study of such subjects as language, mathematics, and natural science is of the highest value as a means of training the reasoning faculty.

At this age the boy's knowledge is more scientific. His facts are no longer so isolated as formerly; they are grouped in classes, the grouping depending on the perception of some common attribute. Association of ideas plays an increasingly important part in the acquisition and retention of knowledge.

Feeling is still more and more modified by ideation. The boy is better able to look into the more distant future. At the age of fourteen boys often begin to think of what shall be their life's work. Often they come to decided conclusions on the point. A mass of feeling is inextricably interwoven with such decision. The important point for the teacher to notice is that the future has now a much greater influence than formerly. The boy is in a less and less degree the creature of present circumstances. This looking to the future and allowing it to have great weight in the determining of present action is to be encouraged as much as possible, as it is what underlies all prudence. The teacher may do much towards developing and fixing the higher intellectual, moral and æsthetic feelings.

Volition being largely conditioned by cognition and feeling generally develops *pari passu* with them. The infant feels an incentive to an action, and the response is instantaneous; the boy of fourteen is no longer a creature of impulse, the impulse to action is curbed, in order that the effects of such act may be well thought over. Of course, this power of weighing the consequences of one's acts before carrying them out, is not at its maximum till long after fourteen; but at this age, in the case of the average boy, it is rapidly developing.

The result of deliberating on the consequences of any definite act depends entirely on what the self is that deliberates. "The more memory and the dominant feelings determined by memory obtain a hearing, the more does a man's nature, as a whole, and not merely a single momentarily predominant side of it, obtain influence upon the action."*

A boy (or girl) if properly educated gains considerable power of determining his actions by an established self. On leaving school and taking his place in the world where he is no longer under the guidance and command of the teacher, it is a great misfortune if such a more or less stable self has not been formed. It not infrequently happens that children who are brought up in accordance with the strictest moral principles do not turn out to be the most strictly moral men and women. The explanation is that they are not gradually trained to exert their own will, but are kept entirely subjected to the will of others, until the time when such controlling influence is removed. It has never been made to appear necessary for them to rely on themselves and, consequently, when self reliance is an absolute necessity it is not forthcoming.

To trace mental development through the third and fourth stages would be beyond the scope of this book.

It should be noticed that all mental development is essentially becoming more and more independent of circumstances; complete independence is never attained, but the normal adult is far less dependent on his immediate environment than is the infant in the cradle. In all the phases of mind it is the same. Development is, in all, essentially a march towards freedom.

---

* Höffding's Outlines of Psychology, p. 328.

TELEGRAPHIC ADDRESS: "CUSACK, LONDON."

CATALOGUE

OF

Cusack's Series

# of Text Books, &c.

IN

FREEHAND.
MODEL.
SHADING.
GEOMETRY, PLANE.
DO. SOLID.
ARITHMETIC.
ALGEBRA.
MENSURATION.
ATLASES.
MAP DRAWING.
HISTORIES.

COPY BOOKS.
KINDERGARTEN.
ENGLISH LITERATURE.
PHYSIOGRAPHY.
PSYCHOLOGY & LOGIC.
MUSIC. STAFF NOTATION.
DO. TONIC-SOL-FA.
NEEDLEWORK.
REPRINTS OF EXAM. QUESTIONS.

CUSACK'S JOURNAL. Monthly 1d.

SCHOOL STATIONERY OF ALL KINDS

◆

Published by

CITY OF LONDON BOOK DEPOT,
WHITE STREET, MOORFIELDS,
LONDON, E.C.

Cusack's Series of Text Books, &c.,
FOR THE ELEMENTARY DRAWING CERTIFICATE.

CUSACK'S FREEHAND.

PART I. CONVENTIONAL FORMS.—Including Supplement containing 30 Photographic Representations of Casts. *3/6 net, post free 3/11.*

PART II. NATURAL FORMS.—Plants, Animals, and **Common Objects.** *3/6 net, post free 3/10.*

Cusack's Photographic Representations of Ornament, 30 plates, with analysis of each and instructions, being Supplement to Part I., but can be had separately. *1/6 net, post free 1/8½.*

These books form a complete course of instruction in Freehand Ornament, for all who are studying this subject for the Drawing Certificate or for Queen's Scholarship Examination. Part I. contains several hundred Exercises carefully graduated from the simplest curves up to the Examination Standard, with ample instruction in letterpress and explanatory diagrams. Part II. contains several examples of Leaves, Plants, Birds, and Quadrupeds, as well as Common Objects.

Opinions of Experienced Practical Teachers on Part 1.

"I consider Cusack's Freehand Ornament a very useful book, and remarkably cheap." J. T. Cook, *Art Master*, Sheffield School of Art.

"I can honestly recommend Cusack's Freehand Ornament as a book that all Art Teachers should have." H. Burrows, *Art Master*, Huddersfield School of Art.

"It is the most complete book on Freehand Drawing I have seen." W. H. Knight, *Art Master*, Northampton Technical School.

"It is a most valuable work, certainly the best of its kind that has yet come under my notice." John Fisher, *Art Master*, Kensington School of Science and Art, Bristol.

"The designs are good and the methods of construction eminently suited for such pupils as are preparing for the Elementary Freehand Examination, and who are unable to obtain oral lessons. It should command a good sale as the price is very reasonable for so exhaustive a work." "Art Master."

"It is a thorough reliable work, and I should be pleased to see it in the hands of all my pupils." Henry Stott, *Art Master*, Bolton Municipal School of Art.

"It seems to me to be an excellent work, and treats the subject in a thorough and comprehensive manner. It should be of great assistance to students taking either the Elementary or Advanced stages of Freehand." Francis Reily, *Art Master*, Southport Victoria Science and Art School.

"The book is full of very useful specimens suitable to the Elementary Student, and it is evidently the work of a practical teacher." Benjamin C. Hastwell, *Art Master*, Charterhouse Art School, Goswell Road, E.C.

"The work is in book form, and is very suitable for those who wish to study Freehand privately, or to place in the hands of Pupil Teachers, &c. The examples are well chosen, and the method adopted to illustrate the construction cannot fail to produce better results. The directions at the beginning of the book are also very valuable, and I trust that the work will have a wide circulation." W. H. Hey, *Art Master*, Burnley School of Art, Lancashire.

"I consider Cusack's Freehand Ornament, by C. Armstrong, will be of great service to Teachers and Students." Haywood Rider, *Art Master*, Leeds School of Art.

"I have much pleasure in testifying to the great value of Cusack's Ornament. It certainly supplies a distinct want, and I am sure that if it is really studied and taken as a guide, much good will follow." R. B. Dawson, *Art Master*, Rochdale School of Art.

BOOKS PUBLISHED BY PROFESSOR CUSACK.

CUSACK'S MODEL DRAWING.

Second Edition. 3/6 net, post free 3/10.

This book contains over 200 explanatory diagrams and deals fully with many points never before attempted in a book on this subject, and but rarely even in classes. The letterpress is in each instance on the page opposite the diagrams to which it refers.

"A book for students, and one of the most complete and perfect guides to excellence in this branch of drawing that has come under our notice. The subject is dealt with in a most exhaustive manner, and every conceivable position in which the usual models can be placed is shown. We cordially recommend the work."—Schoolmistress.

"Worthy of all praise.—Far ahead of anything we have yet seen."—Schoolmaster.

"The result of several years' practical experience.—Well adapted to its purpose."—Teachers' Aid.

"This is a splendid book, not only because it teaches model drawing on right lines, but because it teaches that *observation* and not mechanical rules must guide the student, and because it teaches what to observe and what to avoid.—We have never seen a more complete book than this one, whether for the elementary teacher or the student going in for his certificates."—Arnold's Art Circular.

CUSACK'S SHADING.

Second Edition. 3/6 net, post free 3/10

This Book contains 3 plates, full examination size, 20 finished plates, and 60 explanatory diagrams. The descriptive letterpress is in each case on the page opposite the plate to which it refers, and on the same page as the explanatory diagrams. Methods of Drawing the Casts, &c., to be shaded receive particular attention.

"This is a good practical work on a difficult subject, and calculated to help students."—Science and Art.

"A very helpful text-book.—Two interesting plates show the different methods of obtaining the 'tones' in stump and in crayon respectively.—Progressive plates are given showing each new difficulty mastered before proceeding to something fresh. This work will be found especially valuable to all who are unable to attend art classes for direct instruction."—Schoolmaster.

"This is a splendid book. We do not wonder to find that it is selling well. We can honestly recommend it. When seen it will recommend itself."—Teachers' Aid.

"The best text-book on shading that has yet appeared."—Arnold's Art Circular.

CUSACK'S HOW TO DRAW THE GEOMETRIC MODELS AND VASES.

9d. net, post free 10d. New Edition.

By A. A. BRADBURY, Art Master; Examiner in Art to the Science and Art Department.

"This is a practical little book on Model Drawing, alike instructive to the student and the teacher."—*Schoolmaster.*

"A few pence will put our readers in possession of one of the most valuable little aids it has ever been our lot to see."—*Schoolmistress.*

"Excellent little book."—*Science and Art.*

"Should be in the hands ot every teacher."—*Board Teacher.*

"A most useful practical body of instruction."—*School Board Chronicle.*

"I think the idea of giving to each student a manual of instruction that contains the methods of construction he must practise to arrive at an accurate drawing, an excellent one. I hope the book may do all you have a right to expect from it." J. C. L. SPARKES,

Principal of the National Art Training School, South Kensington.

"Your work will, I trust, do much to correct the misapprehensions which are so prevalent in reference to Model Drawing."

J. A. D. CAMPBELL, Science and Art Department.

"I think highly of your little book. For shrewdness, brevity, and helpfulness, it is a model on its subject." M. SULLIVAN,

President of the Society of Art Masters.

"I have found your book exceedingly useful and a great help, especially to backward students."—J. VAUGHAN, *Art Master*, London Sch. Board.

"It is a model of conciseness and correct method of teaching. Send me one hundred copies."—J. T. COOK, *Head Master*, Sch. of Art, Sheffield.

"Your little book is full of valuable hints, and bids fair to become a very popular manual with all candidates for elementary or advanced model drawing. I wish it every success." HENRY R. BABB,

Head Master, Plymouth School of Art.

"I think the book is just what I require for my class."

CATHERINE F. MANNING, Diocesan Training Coll., Salisbury.

CUSACK'S PERSPECTIVE.

IN THE PRESS.

CUSACK'S SOLID GEOMETRY.

For SCIENCE SUBJECT I. and for ART GEOMETRY.

3/6 net, post free 3/10.

Being a complete exposition of this difficult subject as now required for the Elementary Drawing Certificate.

By HENRY F. ARMSTRONG, late Art Master, National Art Training School, late Lecturer in Solid Geometry and Perspective at the City of London School of Art, Day Training College, Moorfields, London. Now Professor of Art at the M'Gill University, Montreal.

Opinions of Experienced Practical Teachers.

"The student who now stumbles over that difficult portion, points, lines, and planes, must indeed be a dullard. Mr. Armstrong seems to have excelled in this stage particularly, and it is just here that that very useful box of models and planes called the 'Geometrikon,' issued in connection with this work, will be found very useful indeed. In this it was a brilliant idea to use transparent xylonite for auxiliary planes.

The plates and text are carefully and simply prepared, avoiding all complication, everything being easily understood."

ARTHUR SCHOFIELD, Leeds School of Art.

"I cannot speak too highly of the 'Geometrikon'; it is, I consider, the best thing of its kind I have seen."

J. T. COOK, School of Art, Sheffield.

"The book will be found of essential value to Architectural and Engineering Students. I consider it the best text book I have seen on the subject. The diagrams and Cards (The Geometrikon), showing the different planes in Solid Geometry, will be most helpful to students preparing for the Examination of the Science and Art Department."

H. BURROWS, *Art Master*, 47, West Parade, Huddersfield.

"I have carefully looked through Cusack's Solid Geometry and have decided to use it as a text book in this School. The 'Geometrikon' is a most useful addition to the book."

J. FISHER, *Art Master*, Science and Art School, Bristol.

"I am especially pleased with the 'Geometrikon,' which should greatly lessen, if not entirely remove, many of the difficulties which orthographic projection presents to beginners.

"'Cusack's Solid Geometry' and the 'Geometrikon' certainly form together a most thorough and interesting course of instruction."

G. BEDFORD, *Art Master*, School of Science and Art, Torquay.

"A student who consistently works through your book with the aid of this instrument cannot fail at the May examinations."

B. C. HASTWELL, *Art Master*, Charterhouse School of Art.

"I think your Solid Geometry and the Geometrikon are two *most useful* things, the latter especially supplying a long felt want."

JOS. HARRISON, *Head Master*, Municipal School of Art and Design, Waverley Street, Nottingham.

A STUDENT writes :—"I purchased Cusack's Solid Geometry in March ; I studied it right through, giving all my Easter holidays to it. I was the only student at my centre who passed in Geometry."

TWO STUDENTS write :—"We are the only two in this town who passed in Geometry: all the rest failed. We were the only two who used Cusack's Solid Geometry, and were it not for that most valuable book we should have failed also."

CUSACK'S PATENT GEOMETRIKON.

A BOX OF APPARATUS FOR SIMPLIFYING THE STUDY OF SOLID GEOMETRY.

3/6 net, post free 3/10.

The box contains:—2 mahogany planes connected by patent brass hinges, with spring, which keeps the planes at right angles to one another, so as to represent the vertical and horizontal planes of projection, but which also permits the vertical plane to fall backwards flat, so that both planes represent one flat sheet of paper, and the line between them represents the X Y line.

1 large transparent xylonite plane.

1 large opaque cardboard plane.

14 diagrams from Solid Geometry Book, on paper suitable size to fit into the hinged planes for experimental purposes.

22 auxiliary diagrams, either on transparent xylonite planes or cardboard opaque planes, as required.

1 cardboard specially cut to fold into model of tetrahedron with adjustment showing height of tetrahedron and method of finding it.

1 each small wooden cube, square prism and hexagonal prism.

2 steel pins, bead-headed.

The whole is designed to illustrate all the essential principles of Science Subject 1, from the most elementary to the most abstruse.

CUSACK'S PLANE GEOMETRY.

For SCIENCE SUBJECT I., and for ART GEOMETRY.

Price 3/6 net, post free 3/10.

This book has been specially prepared for Students who wish to acquire a thorough knowledge of Plane Geometry; contains over 300 problems fully worked out with nearly 200 additional exercises.

The descriptive matter is, in each case, opposite the page of explanatory diagrams.

To Students who have not the advantage of Oral Lessons this book will be found indispensable. No one studying it through carefully could possibly fail at a South Kensington Examination in Plane Geometry.

It is uniform in size with Cusack's Freehand, Model Drawing, and Solid Geometry.

CUSACK'S ELEMENTS OF LOGIC.

Prepared expressly to meet the requirements of Syllabus for 2nd year Certificate Students. By S. BLOWS, M.A., Hons. Cantab., B.A., Hons. B.Sc., and Teacher's Diploma, London.—2/6 net, post free 2/9.

CUSACK'S ELEMENTS OF PSYCHOLOGY.

By S. BLOWS, M.A.—2s. net, post free 2s. 3d.

BOOKS PUBLISHED BY PROFESSOR CUSACK.

NEEDLEWORK FOR STUDENT TEACHERS

By Amy K. Smith, Diplomée of the London Institute for the Advancement of Plain Needlework. Special Needlework Demonstrator at the Day Training College, Moorfields, E.C. With an introduction by the Lady Wolverton. 3/6 net, post free 3/10. 5th Edition.

NEEDLEWORK DIAGRAMS.

By Miss A. K. Smith.

Specially prepared for Scholarship and Certificate Candidates, and for P. T.'s.

Scholarship, 1/- net. First Year Women, 1/- net.
Second Year Women, 1/- net.
Candidate P. T's., 9d. net. First Year P. T's., 5d. net.
Second Year P. T's., 6d. net.

We strongly advise all Students troubled about the "Needlework requirements," to invest 1/ in the purchase of a set of papers on the subject by Miss A. K. Smith. These papers are excellent in every way.

Teachers' Aid.

CUSACK'S KINDERGARTEN DRAWING COPY BOOKS.

Complete Series in 8 Nos., 1½d. net.

A preparation for Frœbel's Drawing.

Designed and arranged by C. Pattison, A.F.S.

Specimen pages post free on application.

CUSACK'S KINDERGARTEN DRAWING EXERCISE BOOK, 4½d. net.

Interleaved with tissue. Specially prepared for drawing Kindergarten Diagrams, and for Students' use.

CUSACK'S REPRINTS OF SCHOLARSHIP QUESTIONS.

10 years—1890–1899. All subjects classified.—2/ net, post free 2/2.

Including Answers to Arithmetic Questions.

CUSACK'S REPRINTS OF CERTIFICATE ARITHMETIC QUESTIONS.

1/ net, post free 1/1.

Including Answers to Arithmetic Questions.

BOOKS PUBLISHED BY PROFESSOR CUSACK.

CUSACK'S
TONIC SOL-FA MUSIC QUESTIONS.

And How to Answer Them. **1/- net.**

CUSACK'S LECTURES ON MUSIC.

Staff Notation.

3rd Edition. **2/- net, post free 2/3.**

This book comprises all the requirements in Staff Notation for Pupil Teachers of all years, Scholarship Candidates and Certificate Students of both First and Second year.

It deals very fully with Clefs, Minor Scales, Intervals, Modulation, Transposition from one Scale to another, and from one time to another, and with the Metronome in a manner never before attempted in any text book on the subject.

"The work is to be commended for its rugged outspoken style, and its terseness."—SCHOOLMASTER.

"The Lectures are thoroughly practical—Ought to prove useful to our readers."—TEACHERS' AID.

"We have gone through the book carefully, and can give it high praise."—
SCHOLASTIC GLOBE.

"An excellent and highly recommendable little work. For cogency of style and clearness of expression the book is admirable, evidencing unmistakably the wide experience of the author in imparting instruction. The book is calculated to prove of much service to the Student, from the clearness and force of its style, and the thoroughness and earnestness with which the various subjects are put before the tyro."—KEYBOARD.

CUSACK'S ALGEBRA.

PART I. (ELEMENTARY),

Without Answers 2/6 net, post free 2/9. With Answers 3/6 net, post free 3/10.

Written expressly for

Scholarship Candidates (Girls), and for Second Year Women Certificate Students.

Adopted by the Chief Pupil Teachers' Centres, Training Colleges, &c.

OPINIONS OF EXPERIENCED PRACTICAL TEACHERS.

"The feature of the book is the remarkable fulness of the explanatory matter, making a demonstration on the Blackboard by a teacher quite unnecessary—a good thing for rural teachers who cannot attend a class in Mathematics."

G. M. HANDLEY, Head Master, Oldham P. T. Central Classes.

"Cusack's Algebra is an Excellent Book. Considering the class of Students for whom it is intended, it is without a rival."

JOHN FARISH ROBY, P. T. Centre, Manchester.

"This is an excellent text book, admirably suited for its special purpose, and evidently written by a practical teacher of wide experience."

G. J. RANKILOR, Director, Church P. T. Central Classes, Birmingham.

"It is a good book and very carefully graduated."

W. DONE, Supt. P. T. School, Brighton and Preston, Sussex.

"A great help to private students."

Mr. CANHAM, Mathematical Master, P. T. Centre, Norwich

OPINIONS OF STUDENTS.

"I am a student in a Scholarship Class, I procured your Algebra at the beginning, and I must say that I think it excellent. I have never attempted that subject before, and I was looking forward to its commencement with a dread of all the hard work it would entail. But I am pleased to say that I have taken a great interest in it, and enjoy its perusal exceedingly."

LOUIE ARTHUR, St. Peter's Park.

BOOKS PUBLISHED BY PROFESSOR CUSACK.

CUSACK'S ALGEBRA.

Part II. Advanced.

For Scholarship Candidates (Boys) and Certificate Students (Men), both First and Second Year. 3/6 net, post free 3/10.

Specially prepared for those Students who have not the opportunity of attending Oral Classes. Dealing very fully with Evolution, Theory of Indices, Surds, Quadratic Equations, Equations Involving Surds, Factors, Ratio, Proportion, Variation, Progression, Logarithms, Binomial Theorem, Interest, and Annuities.

CUSACK'S MENSURATION.

For Pupil Teachers, Scholarship Candidates (Boys) and Certificate Students (Men), both First and Second Year. By H. J. SMITH, B.Sc., Lecturer in Mathematics at the Day Training College, Moorfields, London, E.C.—2s. 6d. net, post free 2/9.

"We have long wanted a new book on this subject; the examples in the old ones are worn out. I endorse the remarks of Mr. H. J. Smith in his preface."

W. DONE, Supt. P. T.'s School, Brighton.

"This book is undoubtedly one of the best published. The explanations are simple and clear, and the numerous worked examples exhibit a style well worthy of imitation. The proofs of rules are especially good, and exactly meet the requirements of Certificate and Scholarship students."

G. J. RANKILOR, Director Church P. T. Central Classes, Birmingham.

"1. Many good examples worked out.
2. Exercises good and plentiful.
3. Short cuts plainly indicated.
4. Proofs simply explained.
5. Diagrams very clear.
6. Difficulties anticipated."

H. W. DUFFIN, P. T.'s School, Norwich.

CUSACK'S ARITHMETIC.

For Pupil Teachers, Scholarship Candidates, and Certificate Students, Men and Women. 4s. 6d. net, post free 4s. 10d. Second Edition.

"If it were possible for a book to supersede personal teaching, this book would make a teacher superfluous. We have here a full, clear, concise and amply illustrated exposition of the theory, and a well-selected list of graded exercises embodying every conceivable form of problem. The usual catch questions—train and clock sums, &c., are explained with the aid of diagrams (trains, clocks, &c.), with such clearness that one cannot conceive of an ordinary private student failing to work ever abstruse problems. It is the best work of Arithmetic that we have seen."

PUPIL TEACHER AND SCHOLARSHIP STUDENT.

"No pains seem to have been grudged to make the whole book thoroughly serviceable, and after a careful examination, we have nothing for it but words of commendation. Many pages read like actual demonstrative lectures, with all the mark of a strong personality in the lecturer."—PRACTICAL TEACHER.

"It is, in our opinion, one of the most complete and educative treatises on the subject yet published."—SCHOOLMISTRESS.

BOOKS PUBLISHED BY PROFESSOR CUSACK.

CUSACK'S EDITION OF

SCOTT'S MARMION. Canto VI.

THIRD EDITION. For Candidates, 1901. 2/ net, post free 2/2½.
Over 200 pages, with Illustrations of all the Heraldic, Architectural, and Military Terms used in the Poem.
With coloured map of Flodden district and plan of the battlefield.

AND

THE LAY OF THE LAST MINSTREL. Canto II.

With Architectural Notes and Illustrations. 1/4 net, post free 1/6.

CUSACK'S EDITION OF

GOLDSMITH'S THE TRAVELLER.

1/ net, post free 1/2. Third Edition.
For First Year Pupil Teachers, 1901.

AND

THE DESERTED VILLAGE.

1/ net, post free 1/1½

CUSACK'S EDITION OF

COWPER'S TASK. Book IV.

1/ net, post free 1/2.

COWPER'S EXPOSTULATION. (Lines 1-363.)

1s. net., Post free 1/1½. For First Year P.T.'s 1902.

CUSACK'S EDITION OF "GRAY'S ELEGY."

1/ net, post free 1/2.

AND

The BARD, and ODE ON SPRING.

1/ net, post free 1/2.

CUSACK'S EDITION OF

POPE'S ESSAY ON MAN. Epistle IV.

1/ net, post free 1/2.

CUSACK'S EDITION OF

MILTON'S PARADISE LOST, Book III.

1s. net., Post free 1/2. For Second Year P.T.'s 1902.

These literature books are intended for Pupil Teachers at their respective Examinations. Each contains a Life of the Author, Copious Notes and Explanations, Derivations of all important Words, with Hints for parsing all the difficult words, and analysing the more difficult sentences, with Articles on Figures of Speech, Metre, &c.

Kindly oblige by bringing this under the notice of all Pupil Teachers in your School, or with whom you are otherwise acquainted.

BOOKS PUBLISHED BY PROFESSOR CUSACK.

CUSACK'S EDITION OF
THE LIFE OF MILTIADES.
By CORNELIUS NEPOS.
1s. net., Post free 1/1.

With Historical Introduction, Life of the Author, Map, Grammatical Notes, Full Translation, and Vocabulary of every word in the Latin Text.

CUSACK'S EDITION OF
THE LIFE OF EPAMINONDAS.
By CORNELIUS NEPOS.
1/- net., Post free 1/1.

With Historical Introduction, Life of the Author, Map, Grammatical Notes, Full Translation, and Vocabulary of every word in the Latin Text.

CUSACK'S
THREE HUNDRED YEARS' GROWTH OF THE BRITISH EMPIRE.
(1558-1858).
1s. net, post free 1/2.

Prepared specially for Scholarship Candidates. December, 1901.

CUSACK'S
REIGN OF QUEEN ELIZABETH.
1/6 net, post free 1/8½.

CUSACK'S REIGN OF CHARLES I.
1/ net, post free 1/2

CUSACK'S REIGN OF QUEEN ANNE.
1/ net, post free 1/2.

CUSACK'S
REIGN OF WILLIAM III. and MARY.
1/ net, post free 1/2.

CUSACK'S TUDOR PERIOD.
3/6 net, post free 3/10.

CUSACK'S
ENGLAND UNDER STUART RULE.
3/6 net, post free 3/10.

CUSACK'S MODERN EUROPE, 1814 to 1848.
3/6 net, post free 3/10.

CUSACK'S ATLASES.
THE BRITISH EMPIRE. 1/- net, post free 1/2.
EUROPE. 1/ net, post free 1/2. AFRICA. 6d. net, post free 7d.

CUSACK'S MAP DRAWING.
Specially prepared for Pupil Teachers, Scholarship Candidates and Certificate Students, both 1st and 2nd year, so as to enable them to produce Memory Maps neatly and quickly in the Examination Room.

2/ net, post free 2/3.

CUSACK'S COPY BOOKS.

Adopted by the School Board for London.

New Series. Revised, Re-engraved, and adapted to suit the Standards.

Complete Series in 8 Nos., 1½d. each, net. Over 10,000 Schools and many of the Training Colleges now use them.

Set of Cusack's Copy Books for Teachers' Use, in one volume, 1/6 (cloth)

What Her Majesty's Inspectors say of them:—"We are everywhere meeting with Cusack's Copy Books now, and always with a marked improvement in the Handwriting." "The Handwriting is in style perfect: it combines every excellence." "I am very pleased to see the increased use of your excellent Copy Books in the schools that I visit."

What Head Teachers say of them:—"They are all that can be desired." "The children adopt the style most readily." "The Handwriting of my school has vastly improved since their introduction." "I feel compelled to write and tell you how excellent I find them." "Every school in this town now uses your Copy Books in every department, and the improvement is most remarkable." "I have used your Copy Books with marked success."

What the Press says of them:—"We have seen no better."—SCHOOLMASTER.

"A capital series, worthy of the attention of Teachers. The style of writing is bold, neat, and taking. No. 8 especially so."—TEACHERS' AID.

"The system is simple, most carefully graduated, and results in a style of writing so beautifully legible and yet sufficiently free, that a lad on leaving school can at once take his place at the merchant's desk with nothing in his handwriting either to learn or unlearn."—TEACHERS' MONTHLY.

"We strongly advise Teachers, who are on the look out for a thoroughly good and practical series of Copy Books, to obtain specimens of this admirable series before making their choice."—SCHOLASTIC GLOBE.

CUSACK'S WRITING BOOKS (Blank).

For Blackboard Lessons.

RULED TO MATCH CUSACK'S COPY BOOKS. 1d. each.

CUSACK'S SELECTED PENS.

In 5 grades—Nos. 1 to 5—to suit writing of every size.

No. 1.—A Superior Pen for Commercial Work, or for large hand in Schools.
No. 2.—A Superior Pen for General Correspondence or for text hand in Schools.
No. 3.—A Superior strong hard-pointed Pen, for rapid writing.
No. 4.—A Superior fine hard-pointed Pen, very suitable for ledger work.
Nos. 3 and 4 are suitable for small hand in Schools.
No. 5.—A Superior Mapping Pen.

Each Pen has been carefully tested by hand before being packed, so that they will be found of uniform quality. They are guaranteed to be of the finest quality, and of great durability, being made of the finest Damascus Steel.

Specimens free to Teachers. Packed only in One Gross Boxes.

Prices:—Nos. 1 & 2, 2/- net, per gross. Nos. 3, 4 & 5, 2/6 net per gross.

Sample Box of Assorted Pens, 6d., or 2 doz. of any one number, 6d.

BOOKS PUBLISHED BY PROFESSOR CUSACK.

CUSACK'S LEAD PENCIL COPY BOOKS
FOR INFANT SCHOOLS.

Complete Series in 4 Books. Price 8d. per dozen net.

The objections to slates and slate pencils are many:—

1. It is impossible to hold the slate pencil as the pen *should be held* in writing; hence infants contract bad habits, difficult to eradicate afterwards.
2. The noise of the pencil on the slate is unpleasant, and irritating to many.
3. As the copies are all rubbed out, there can be no permanent record of the child's work or progress.
4. The means adopted in many cases for cleaning the slate is an effective cause of the spread of infectious diseases among children.

These and many other objections are at once obviated by the use of Paper and Lead Pencil.

In the above series of Copy Books, besides the Headlines being given in a bold style, the whole page is outlined with the given copy.

The very low price quoted, **only Eightpence per dozen,** *should bring them within the reach of all Schools.*

Specimen set (free) will be sent to the Head Teacher of any Infant School.

CUSACK'S BRITISH MADE LEAD PENCILS 8/. NET PER GROSS.
EVERY PENCIL SHARPENED.

CUSACK'S SHORTHAND NOTE BOOK,
200 pp., 4½d. net.

CUSACK'S JOURNAL.

A Monthly Newspaper for Pupil Teachers, Acting Teachers, and all Teachers.

Containing much instructive and educative matter. All current topics dealt with. Published 15th of each month, price 1d.; by post, 1½d., or of all newsagents and stationers.

CUSACK'S
HISTORICAL GEOGRAPHY OF EUROPE.
1700 to 1789.

It deals very fully with History, General Aspect, Trade, Industries, Politics, Religion, and Social Standing of each Country, and contains several coloured maps.

CUSACK'S ANGLO-SAXON TRANSLATIONS.

With Vocabularies in the order of the text.
Extracts from Sweet's Reader. 7/6 net, post free 7/9.

BOOKS PUBLISHED BY PROFESSOR CUSACK.

CUSACK'S PHYSIOGRAPHY.

571 pp. 3s. 6d. net.

By S. W. Davies, Associate of the Royal School of Mines, Murchison Medallist and Prizeman, late Royal Exhibitioner, Senior Science Master, and Lecturer in Physiography at the Day Training College, Moorfields. Specially prepared to the Elementary Stage of the South Kensington Syllabus, and for Pupil Teachers, Scholarship Certificate Students (Men and Women).

"Cusack's Physiography is an excellent book, well up to date in scientific matter, and thoroughly suitable for P. Ts. I can strongly recommend it."
T. H. Kemp, P.T. Classes, Merthyr Tydfil.

"Cusack's Physiography is an excellent book for Pupil Teachers, and other students who intend taking up the Elementary Stage of Physiography. It has the great merit of being extremely clear, and is easy to understand."
A. H. Emms, Norwich.

"I consider Cusack's Physiography to be a first-rate work."
W. Furneaux, P.T. Centre, Peckham, S.E.

"It seems to be written in a thoroughly simple and masterly way."
Rev. J. P. Faunthorpe, Whitelands College, Chelsea.

"I consider Cusack's Physiography a most useful book, well arranged, and well suited to the needs of Advanced as well as Elementary Students, to whom I shall have pleasure in recommending it."
John T. Dickinson, Central Schools, Peterborough.

"Cusack's Physiography is adapted to the requirements of the present Syllabus of Elementary Physiography, and I have no hesitation whatever in recommending the book, either to outside candidates for Elementary Physiography, or to Students in Training Colleges."
F. S. Buck, St. Hild's College, Durham.

CUSACK'S OBJECT LESSONS.

By LOUISA WALKER,

Head Mistress of Fleet Road Board School, Hampstead,
(Infants' Department).

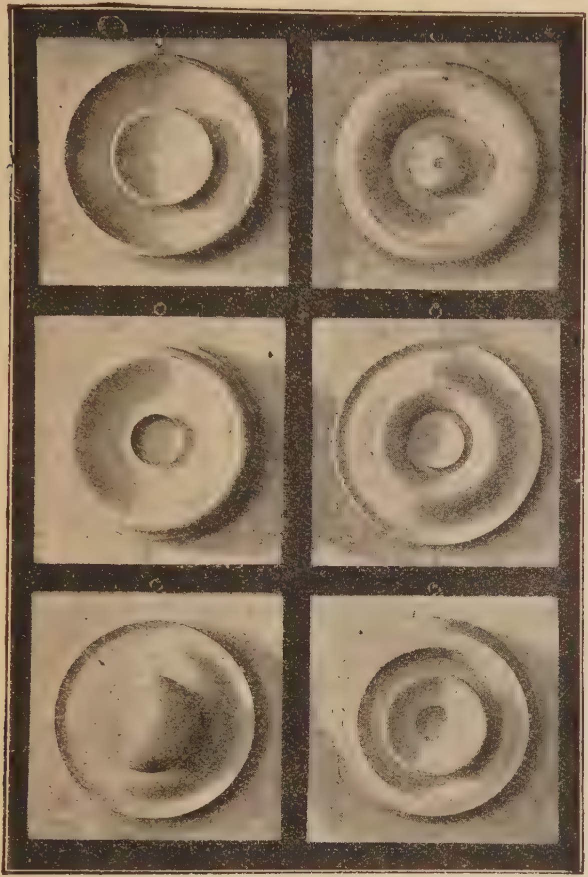
Part I.—2/ net, post free 2/3. Part II.—2/6 net, post free 2/9.

CONTENTS OF PART I—
ANIMAL WORLD.

Bat — Bear — Beaver — Bees — Butterfly— Camel — Cat — Codfish — Cow —Cuckoo—Dog —Duck — Eagle — Elephant — Frog — Giraffe — Goat — Hedgehog—House Fly—Horse—Lion—Mole—Monkey—Ostrich—Pig—Polar Bear—Rabbit—Reindeer— Robin— Seal — Sheep — Silk and the Silkworms—Spider—Squirrel—Swallow and the Whale.

CONTENTS OF PART II—
MINERAL AND VEGETABLE WORLD AND COMMON OBJECTS.

Apple — Bone—Butter—Buttercup—Candles—Chalk—Coal—Cocoanut—Coffee—Coins in Use—Copper—Cork—Corn—Cotton—Cup and Saucer—Earthenware — Egg —Feather—Flax—Fruit—Fur—Glass—Gold—Gutta-percha—Honey and Wax—Horn—India-rubber—Iron—Ivory—Knife and Fork (Parts)—Knife and Fork (Manufacture)—Lead—Leather—Leaves—Milk—Needle (Parts)—Needle (Manufacture)—Orange—Paper—Penny—Potato—Pins— Salt — Silk — Silver — Slate — Soap — Sponge —Sugar—Tea—Tin—Tree (Parts)—Wood—Wool—Zinc.



From a photograph of the set of casts.

CASTS FOR SHADING.

CUSACK'S SET OF SIX ELEMENTARY ROSETTE FORMS.

(In Wood) afford the best possible practice for beginners in Shading.

On several occasions the Examination in Elementary Shading was based on a rosette.

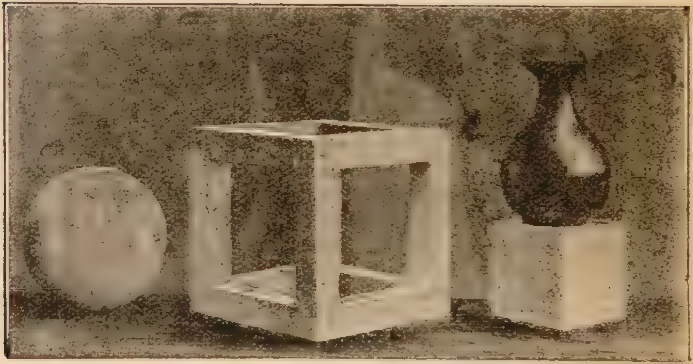
Price 12/- net, Carriage Paid. Packing Cases and Packing Free.

CUSACK'S SET OF 10 DRAWING MODELS.

Perfect in shape, strongly made in wood; and painted. In two sizes: Large and Small. The large is the size for Schools of Art and Art Classes. The size prescribed by the Science and Art Department for the May Exams. Large size: cube 10 in., and other models in proportion, as shown in diagram. The small size (cube 6½ in., and other models in proportion) is for students' private study.

Prices—Large Size, 40/- net; Small Size, 20/- net.

Carriage paid. Packing Case and Packing Free.



CUSACK'S SET OF 4 MODELS.

Sphere, Skeleton Cube, Small Cube, Vase. In Wood.

Carriage Paid and Packing Free.

In two sizes: Large size, 16/- net; Small size, 8/- net.

Or the 14 Models complete in One Set—Large Size 56/- net, Small Size, 28/- net.